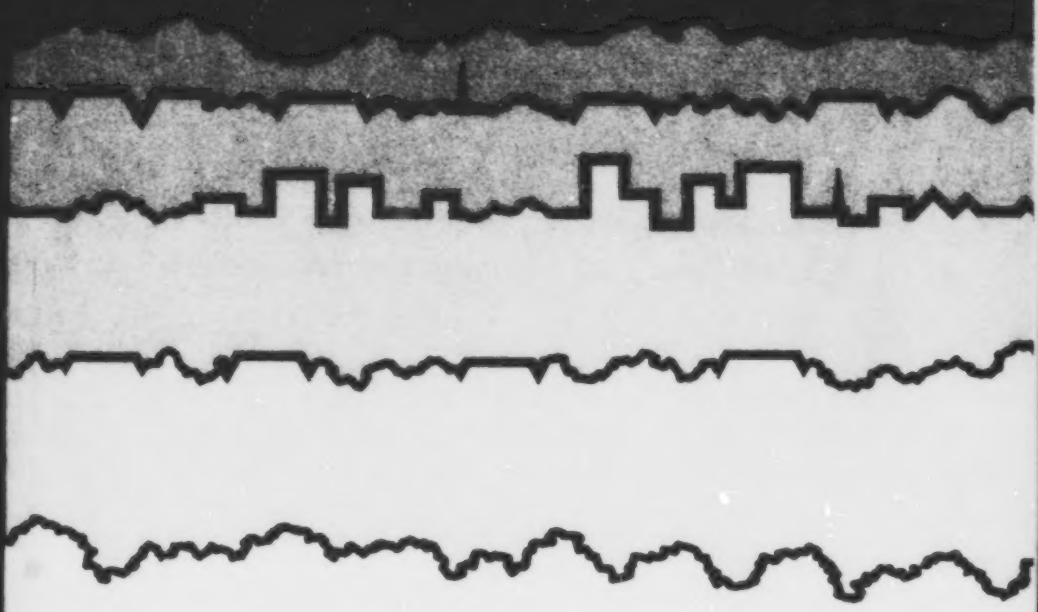
CEARC Canadian Environmental Assessment Research Council

CCREE Conseil canadien de la recherche sur l'évaluation environnementale



Sustainable Development and Environmental Assessment: Perspectives on Planning for a Common Future

Peter Jacobs and Barry Sadler

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A Background Paper Prepared for the
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Foreword

The Canadian Environmental Assessment Research Council (CEARC) was established in January, 1984 by the federal Minister of the Environment to advise government, industry, and universities on ways to improve the scientific, technical, and procedural basis for environmental assessment (EA) in Canada. CEARC has commissioned research studies on many aspects of EA, including cumulative effects assessment, social impact assessment, health, sustainable development, economy, monitoring, negotiation, and mitigation.

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Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.

World Commission on Environment and Development, *Our Common Future*. New York: Oxford University Press, 1987, p. 43

Environmental (impact) assessment is a process which attempts to identify, predict and mitigate the ecological and social impacts of development proposals and activities.

Canadian Environmental Assessment Research Council, *Philosophy and Themes for Research*. Ottawa, 1986, p.1

Environmental assessment is a necessary but not sufficient process for achieving sustainable development... In this regard, there is an urgent need for second generation assessment processes, employing new and expanded concepts, methods, and procedures ... coordinated with other planning and management instruments as part of an overall approach to environment-economy integration.

Conclusions and Recommendations on Further Directions for Research and Development, p. 171.

Introduction

The objectives of this study are twofold:

1) to promote discussion of the role and contribution that environmental assessment (EA) and related processes can make to planning and implementing sustainable development; and

2) to identify productive directions for applied research that exemplifies and improves this relationship, including demonstration projects that "use-test" new concepts and methods.

As the title of this volume implies, it is responsive to the report of the World Commission on Environment and Development. The contributors were asked to be critical and provocative in their analysis of sustainable development and its interaction with environmental assessment. In the initial terms of reference, sustainable development was broadly defined as a normative concept, one which fuses economic, social, and ecological goals and values and calls for new approaches to decision-making. Environmental assessment was also flexibly conceived as a process that contributes to the identification of 1) the biophysical and 2) the social dimensions of sustainable development at all levels of decision-making.[1] The perspectives contained in this volume elaborate on these starting premises. Many of them were discussed at two round tables attended by EA practioners and policy analysts of sustainable development in late 1988.

The essays are organized into two parts. Each of the main sections is prefaced by a short note that readers may find helpful in piecing the report together. In this section, we introduce the theme and approach

[1] Environmental assessment and environmental impact assessment (EIA) are often used interchangeably. We use the former instead of the latter term in the title of this volume and throughout the first chapter to convey a more catholic and proactive approach than that implied by the prevailing institutionalized applications of the process. Other contributors prefer to stay with the term EIA. The important point here is not semantics but the expanded scope of the E(I)A process and its creative integration with other components and instruments of planning, which are exemplified in the discussions that follow.
For example, the forms that EA may take include: analysis and screening of policies and programmes, resource evaluations for regional planning, and modelling and monitoring of cumulative changes in natural and managed ecosystems. Impact and risk assessment of large-scale projects and hazardous facilities, conventionally based on ecological and socio-economic prediction, will continue to be an important component of the field. But this approach could be applied to a much wider range of economic activities and resource management practices, and extended to post-assessments or environmental audits of existing developments. Sustainable development imperatives may act as a forcing bed for this shift.

of the study, focusing on transactional issues of defining sustainability and interpreting the implications for environmental assessment, planning, and management. Part I comprises an in-depth evaluation of the effectiveness of existing and alternative EA approaches in supporting decision-making for sustainable development. It is followed by a second level paradigmatic evaluation, which probes into the fundamental characteristics of ecological and social sustainability, and the limitations and delimitations of the philosophical and institutional frameworks for environmental assessment. A series of recommendations on further lines of research and development and a synopsis of round table discussions conclude the volume.

A Key to Tomorrow: On the Relationship of Environmental Assessment and Sustainable Development

Barry Sadler and Peter Jacobs

It is possible to reach knowledge that will be of much utility in this life . . . and so make ourselves masters and possessors of nature.
(Rene Descartes, *Discourse on Method*, 1637)

Daily news events remind us that our relationship with the earth is changing, often in ways that we do not understand.
(Lester Brown, et al., *State of the World*, 1987)

Introduction

Cartesian philosophy provides the underpinnings of the scientific rationality and technological optimism that have primed the pump of economic growth in the industrial age. The results, some 350 years after the *Discourse on Method*, have indeed made mankind "masters and possessors of nature." But the environmental costs are high and rapidly escalating. A global ecological crisis is in the making. The scale of human activities threatens to impair the habitability of the Earth itself (Brown *et al.* 1987).

Environmental concerns are now at or near the top of the international and Canadian political agendas. The reports of the World Commission on Environment and Development (1987) and the National Task Force on Environment and Economy (1987) have acted as catalysts in this respect. They underline the urgency and importance of achieving sustainable forms of development, and identify the scientific, technological, and institutional changes that will be necessary in support of that goal. We must begin to rethink and restructure the processes and procedures of decision-making, including the underlying ideas and methods that shape our definition of problems and predetermine approaches to dealing with them.

Environmental assessment (EA), in this context, is one of the keys to achieving sustainable development. This process is widely employed in Canada and other countries to integrate ecological and social considerations into development planning and control. It also has a number of well-documented deficiencies in this respect. The call to strengthen EA and related procedures is contained in both the World Commission and National Task Force reports and echoed in more

recent statements (e.g., Science Council of Canada 1988). Several studies dealing with aspects of this challenge are being undertaken by the Canadian Environmental Assessment Research Council (CEARC).

This report, in the jargon of the field, is a scoping exercise. It offers a policy-oriented interpretation of the *concept* of sustainable development and what it means for the process and practice of environmental assessment. A reflexive view of this interrelationship also suggests that recent experience with environmental assessments can help sharpen thinking on the enabling conditions of sustainable development. Brundtlandian notions of sustainable development, while immensely valuable, only take us so far in this last regard. The discussion here, therefore, may be of interest to a wider audience than just the EA community.

In this chapter, we provide context and direction for the study. First, the global scope of the ecological transformation is reviewed, important not only in its own right but for what it tells us about the necessity of sustainable development and the scientific assumptions and institutional conventions that circumscribe environmental assessments. Second, the relevance and practicality of sustainable development as a policy concept is questioned; we ask whether and how this ideal can be translated into decision-making terms. Third, within that context, there is a profile of the state-of-the-art of environmental assessment, broadly conceived along the lines outlined in the preface to this section. And finally, the questions that follow from this analysis are related to the themes and approaches taken in subsequent papers.

Background: Humanity, Technology, and Ecology

The driving force behind the search for sustainable development, and the means to achieve it, is a deepening and pervasive sense of environmental crisis. At both the global and national level, the nature of the current environment/development problematique is well documented. For present purposes, the emphasis will be on the underlying causes and main dimensions of the ecological crisis, and their links to the path of western industrial development and the scientific and technical paradigms or world views on which it is based.

The Human Imprint

A biohistory of the human tenure on earth shows a massive recent expansion in the nature, magnitude, and scale of environmental

impacts (Thomas 1956; Boyden 1987). The long-term changes that now concern us are regional and global, encompassing the effects of the overall pattern of economic activity on the biosphere and atmosphere. On this level, key examples of environmental change include:

- global warming and loss of stratospheric ozone, which represent the cumulative effects of intensive, energy-based industrial development on the biogeochemical cycles that constitute the basic life support systems of earth (Bolin and Cook 1983); and

- continued reduction in biological diversity, (i.e., of living species that maintain ecosystems in a productive and resilient state), which is now seen as an equal or even greater threat to the future of mankind than climate change (Wilson and Peter 1988).

These and other trends and changes are interrelated through complex and often reinforcing chains of cause and effect that are still not well understood. Land clearance and habitat reduction in tropical forests, for example, are having significant effects on both global warming and loss of biological diversity (Myers 1984). On this continent, the increased temperature and precipitation effects associated with global warming are expected to become more pronounced with increasing latitude. While regional changes are difficult to predict on the basis of current models, the socio-economic dislocations associated with impacts on land use, agriculture, resource production, and human settlement threaten to be profound.[1] North of 60°, in the Arctic realm, there is the additional problem of ozone thinning in the upper circumpolar atmosphere, and consequent increases in ultra-violet radiation which carry important repercussions for aquatic marine and terrestrial plant growth and food chains as well as for human health (World Meteorological Association 1985). How well we can actually cope with these changes will depend on whether the transition to a new climatic regime is quick and discontinuous or smooth and gradual.

[1] A more immediate concern for Canadians is the mounting toll of air and water pollution and the cumulative ecological stresses that occur as a result of inadequate land and water management (Peterson *et al.* 1987; Sonntag *et al.* 1987). Soil erosion is a case in point where the lessons of biohistory learned in the drought years of the "dirty thirties" have been forgotten or discarded. The Senate Standing Committee on Agriculture, Fisheries and Forests (1984) recently warned that losses of soil productivity on the prairies could significantly impair Canada's capability to produce and export food.

Over-exploitation of natural resources in the Third World is the price of poverty rather than of prosperity. It is evident, for example, in both rural and urban lands and in the changing relationship between them. A widening swath of environmental devastation surrounds many rural villages of the Third World (IUCN 1980). This is the imprint of a desperate search for subsistence and survival that drives more and more people to rapidly growing cities, where they often lack the most basic of services. Meanwhile, the yawning gap of inequality between the industrial and developing countries continues to widen. The latter struggle to catch up by adopting the very model of western industrial development that has brought the world to its present crisis.

Human intervention in natural cycles and processes, empowered by science and technology, is modifying the climatic and ecological balance at a rate much greater than anything experienced in the past (World Resources Institute 1988). In some cases, notably the build-up of carbon dioxide to current levels, this is outside the known range of natural fluctuation. The estimated rise in mean surface temperature during the next 50 years is between 1.5° and 4.5° C. At the top end of the scale, this would be the highest figure during the last 150,000 years. Such changes seem inevitable if we continue along present pathways of development. Whether we have, in Reppeto's (1985) phrase, "world enough and time," a sufficient window of opportunity to manage change, is ultimately a matter of judgement, values, and risk orientation.

The Evolution of Perspective

Our view of the world and our approaches to problem-solving are founded on, and circumscribed by, systems of knowledge and values. All cultures have their characteristic outlook on the world and humanity's place in the scheme of things. So does each age. The current scientific paradigms or frameworks by which we understand and explain aspects of the relationship of society and nature are undergoing a significant transformation. New thinking about the models and the tools of analysis we employ is driven by the scale and magnitude of the present ecological crisis. A paradigm shift is taking place, and the existing framework is no longer capable of solving the problem it defines (Kuhn 1962). The restructuring of our scientific understanding encompasses both fundamental questions about the world we live in as well as the contemporary problematique of environment and development.

It may be useful to illustrate this point by outlining some of the key changes in western ideas about the habitable Earth (Glacken 1956).

Early teleologies of divine creation and the clockwork mechanism of Newtonian physics have been replaced by the geological science of "time's arrow," the relative, Einsteinian universe of quirks and quarks, and the evolutionary biology of Darwin and his successors. The theory of natural selection, of slow cumulative adaptation of species to their ecological niches, has been partly modified in the late 20th century by the ideas of punctuated equilibria and sudden catastrophe. More radically, the view of life adapted to the physical regime and climate of Earth has been recast in the Gaia thesis, which argues that the reverse is also true (Lovelock 1988).

On the Gaian Earth, the biosphere and geosphere are interdependent, mutually regulating systems, and urban-industrial man is the main source of global disruption and potential malfunction. Whether adopted as model or metaphor, the Gaia thesis provides new perspectives on the contemporary reality of human-environment interaction. A recent book on the science of chaos is an attempt to understand the deeper underlying complexity and uncertainty that characterizes biophysical and socio-economic systems. It explains, for example, the "butterfly effect" of small, insignificant changes producing large differences because the processes at work are non-linear, irregular, and discontinuous (Gleick 1987). Ecological systems are typically characterized by variability and resiliency; they withstand considerable stress before change in their structure and integrity becomes manifest. Often change takes the form of "structural surprises," or rapid breakdown in the regional landscape (Holling 1986).

The evolution of perspectives on the interaction of man and the biosphere carries some important implications for mainstream development ideology. Most industrial and developing countries subscribe to the credo of increasing growth, production, and material wealth through the exploitation of land, resources, and the environment. This world view has promoted the expansion of an interdependent world economy, characterized by extremes of affluence and poverty, and by mounting pressures on natural resources and ecological processes. It is now becoming enmeshed in its own contradictions; that is, present patterns of development are increasingly self-defeating because they threaten to undermine the resource base on which they depend. As the Science Council of Canada (1988) notes, science and technology remain powerful tools for corrective change. Their contemporary application to problem-solving, however, must be tempered by explicit recognition of the limits of the Earth and the limitations of our understanding of the governing processes and the cumulative impacts of human intervention.

This concern is a particular challenge to orthodox economics, which provides the main intellectual underpinnings of current development policies. Until recently, water, air, and other natural resources were merely treated as free goods in the economic calculus. It is now accepted that the environmental and related costs of resource and economic development should be analyzed and accounted for. The critical point, however, is that these values continue to be narrowly conceived, and implicitly discounted against monetarized measures of gain in benefit-cost and other procedures for determining the viability of development. New methods for broader-based valuation are being sought: conventionally via extended benefit-cost analysis (Dixon and Hufschmidt 1986); and somewhat less conventionally through community and ecological economics (Schumacher 1974; Pearce 1980). All of these approaches represent attempts to analyze development as if people and environment mattered (Figure 1). The fact of the matter, however, is that they still appear to exert only a marginal influence on the neutral, rigorous approach of orthodox economics, which is designed to separate facts from values and utility from ethics.

The conservation movement has evolved, in part, as a counterweight to mainstream development ideology. It, too, has been characterized by internal contradictions and conflicts (Nash 1976), notably the separation of human needs and ecological values. An early schism occurred between the aesthetic and utilitarian streams of conservation.[2] Both streams converged to some degree around a middle ground of ecological concern that dates back to the land ethic of Aldo Leopold (1949) and became more sharply focused in the "new conservation" of the 60s and 70s. Public concern for the quality of the environment and the integrity of spaceship Earth led to government reforms organized around the regulation of development and the institutionalization of environmental assessment and related procedures. Environmental assessment, for reasons noted later, is only a partial and incomplete response to the problem of reuniting conservation and development. The potential of this approach awaits a more inclusive framework; the evolution of a paradigm that "circumscribes the whole" (Jacobs 1987).

[2] The former emphasized the preservation of nature in national parks and protected areas which were and, to a large degree, still are wilderness reserves from which the trappings of development are excluded. The utilitarian camp promoted an extended economic concept of conservation as the rational use of natural resources, reflected by the gospels of efficiency and sustained yield in forest and wildlife management.

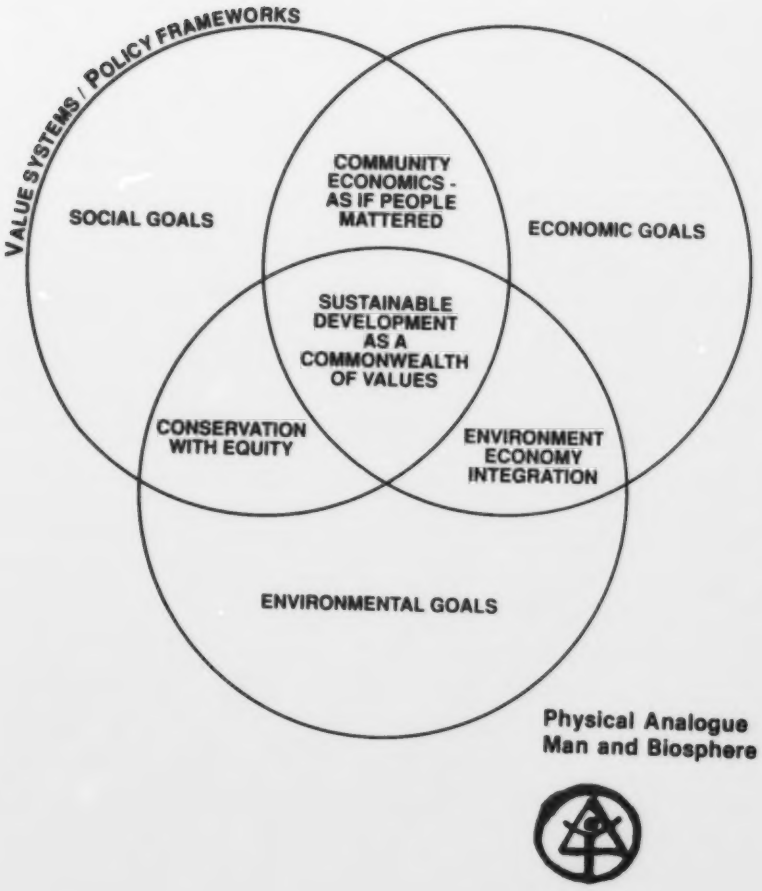

Figure 1. A Systems Perspective on Sustainable Development
Source: Sadler (1990a)

Sustainable Development: A Framework for Analysis

During the 80s, sustainable development has emerged as a key concept designed to link environmental and economic analysis and activity. It is an idea that has gained currency through the work of the World Commission on Environment and Development. *Our Common Future*, according to the Commission (1987:8), will be served by the extent to which we foster development that meets human needs and does not foreclose the environmental and socio-economic options of present and future generations. Similar ideas have been promoted for some time in the conservation literature. But only recently, under the imposition of crisis and threat, has sustainability a) found its way onto the political agenda, and b) become an *overarching goal* and frame of reference for conservation and development activities.

An important range of issues must be addressed if sustainable development is to become more than a promising idea. What is involved in sustainable development? How should we go about merging the conceptual and ideological frameworks of economics and environment which, to date, have been conflicting rather than complementary? What changes are necessary to values, policies, and institutions? How might these be implemented in the public and private sectors? Such questions are now beginning to receive critical attention. To gain perspective, it will be useful to delve into early conservation ideas and the recent evolution of ecological economics.

Beginnings and Mileposts

The notion of sustainability, broadly conceived, can be traced to the start of the conservation movement. It was reflected, but not explicitly stated, in the prophetic writing of George Perkins Marsh (1866), who warned "that the Earth was given ... for usufruct alone, not for consumption, still less for profligate waste." By the early 20th century, the Conservation Commission of Canada, like its counterpart in the United States, was officially promoting the view that humanity's power to transform the natural world should entail a commensurate sense of responsibility and stewardship. This theme was the harbinger of the more comprehensive approach to resource management and wilderness preservation which became manifest in the inter-war era, when depression and drought underscored the importance of conservation and its role in the economic reforms of the New Deal.

A stronger ecological and ethical framework for the conservation movement, a basis for contemporary views of sustainable develop-

ment, was outlined in the essays of Aldo Leopold (1949). His classic book, *A Sand County Almanac and Sketches Here and There*, is a compelling testimony of the complex interrelationship and dynamics of natural systems and of the importance of a "land ethic" and "conservation aesthetic." A sense of responsibility, Leopold pointed out, comes from and must reinforce the integrity and beauty of the biotic community. This ethical relationship is founded on the science of ecology and linked to human values for land as community. Land use and resource development, in Leopold's view, are not solely matters of economic viability, although that is important. Rather they must be examined in terms of what is ethically right, (and that is determined in turn by what is ecologically correct).

This perspective provides the philosophical foundation for the World Conservation Strategy (IUCN 1980), which has inaugurated the newest phase of the environmental movement. It is reflected in the central theme of the document *Living Resource Conservation for Sustainable Development*. Sustainable development involves both coming to terms with resource limits and meeting the needs of present and future generations. A particular emphasis in the World Conservation Strategy is given to the role of conservation in improving the lot of the rural poor in Third World countries. This shift by the IUCN and other conservation organizations, from a rear-guard defence of endangered species to a strategic initiative to improve human welfare and halt the deterioration of the biosphere, represents a consolidation and extension of previous trends.[3]

Following the launch of the World Conservation Strategy, other events served to reinforce and add weight to its message of sustainable development. These included the report of the North-South Commission (1981); the proclamation of the U.N. World Charter for Nature (1982); and the World Industry Conference on Environmental Management (1984). A systematic review of recent efforts to implement the World Conservation Strategy was held in Ottawa in 1986. The discussion was interwoven around two major themes (Jacobs and Munro 1988):

- the need for development that is both sustainable and equitable; and
- the establishment of a broader context for conservation.

[3] Some of the key milestones on the road to the introduction of sustainability included: the Club of Rome's (1969) statement on the limits to growth; the U.N. Conference on the Human Environment (1972); and the U.N. Conference on Human Settlements or Habitat (1976). Further discussion of these trends is undertaken by de Laet in this volume.

Key recommendations called for a clearer definition of the relationship between the themes of sustainable development and of peace, justice, and security, and between the conservation movement and the interests of indigenous and other peoples whose livelihood and culture is directly related to land, resources, and environment.

The Brundtland Agenda

The U.N. World Commission on Environment and Development incorporated and repackaged many of the above lines of thinking in its landmark report, *Our Common Future*. This is, first and foremost, a statement of concern about the fate of the Earth. The report, secondly, underlines the fact that environment and development processes are interdependent and that a broad integrated perspective is necessary to deal with them. A third and related theme is that such a perspective must encompass and address the problems of world poverty and inequality. The Commission (1987:9) concluded that a new path of sustainable development is required, defined as:

> *"a process of change in which the exploitation of resources, the direction of investment, the orientation of technological development and institutional change are made consistent with future as well as present needs."*

The agenda for institutional and legal reform put forward by the Brundtland Commission encompasses several priority areas for international and national action. It encompasses general recommendations for fostering more informed decision-making, including the strengthening of capabilities and responsibilities in resource management and environmental assessment, and contains suggestions for more effective approaches to dealing with scientific uncertainty and interest-based controversy.

Canadian response to the Brundtland agenda for sustainable development has taken a number of forms. The most direct and visible is the *Report of the National Task Force on Environment and Economy* (1987). The multi-partite task force proposed the preparation of conservation strategies to adapt the principles of sustainable development to regional conditions and interests; the establishment of multi-sectoral round tables on environment and economy; and the use of demonstration projects to test and illustrate new concepts and techniques for integrated analysis and decision-making. A final report by the National Task Force (1987) indicates the progress that has been made in implementing these recommendations.

The main contribution of the National Task Force, like that of the Brundtland commission at the international level, lies in the creation of a new climate of public and political support for the principles of sustainable development and the encouragement of research action and cooperation to translate these into practice. A broadly based consensus has emerged on the importance of this new path to securing our common future. Much less agreement, however, exists on how to get there.

An Operational Perspective

An operational perspective on sustainable development involves moving beyond definition and toward identifying practical terms of reference for decision-making. This can be achieved in preliminary form by re-organizing and augmenting the goals, principles, and criteria that are established or implied by the themes of sustainability outlined above. Once these substantive requirements are formalized, we will be in a better position to design policy and institutional options for the practice of sustainable development.

To begin, the critical questions are: sustainable development for whom and for what purpose? It will be evident from previous discussion that sustainable development is oriented toward achieving environmental, economic, and social priorities. For present purposes the key goals might be specified as:

- meeting basic human needs for material welfare;
- maintaining the ecological integrity of natural systems; and
- providing for equity, social justice, and choice of lifestyle.

An elaboration of these goals can be found elsewhere (Jacobs and Munro 1988), and in Gardner's paper in this volume. The main point for emphasis here is their interdependence and co-equality. Sustainable development is best conceived as a commonwealth of goals and of the value systems and policy concepts that respectively give them definition and force (Sadler 1988a). Figure 1 is an attempt to schematically illustrate this notion.

Several implications follow from this systems perspective on sustainable development.

1. The schematic model suggests that a conventional approach to development, often narrowly based on orthodox economics, must be replaced with a broader, more integrated framework for analysis and choice. Figure 2 summarizes some key components and criteria.

2. As an overriding policy construct, however, the transactional notion of sustainability presents certain analytical difficulties. It incorporates, for example, goals that cannot be maximized simultaneously. Quite different intellectual models and modes of judgement and valuation are juxtaposed in Figure 1. The cross-cutting or linking themes also encompass distinct orientations. For example, the contemporary discussion of environment/economy integration tends to focus on government and industry reorganization and partnership and to overlook the concerns of distributive justice that are central in "community economics" and "conservation with equity."

3. The achievement of sustainability requires trade-offs among and within competing and contingent priorities. This should not, however, be taken to mean politics or business as usual. It involves instead a balanced accommodation of values and interests that must be disciplined by the context within which it is undertaken. Sustainable development, in our view, includes meeting all of the goals identified above at some minimum or threshold level. A corollary is that no goal should be consistently promoted or discounted at the expense of the others.

4. More specifically, the continued functioning of natural systems represents the enabling condition of sustainable development. Environmental limits are finite and once crossed the resulting changes in ecological resiliency, resource productivity, and assimilative capacity may be irreversible. Figure 1 thus has a physical analogue in which the constraints of natural thresholds are represented abstractly.[4] So long as they lie within these limits, quite different environment-development pathways, patterns of land use and settlement, and/or individual economic activities may

[4] In reality, of course, such thresholds are difficult to identify and assess. The complexity and uncertainty of evaluating biophysical sustainability also increases with time and space. For example, it is much more problematic to assess the food-producing capability of the world over the next century than that of the prairie wheat belt over the next decade and both are very different propositions than assessing the productive capability of a single farm unit for next year (Pezzey 1988).

be legitimately interpreted as biophysically sustainable. The interpretation of limits to growth will vary to a certain degree with differences in development ideology as well as regional ecology.[5]

A useful concept for formally organizing the interpretation of sustainable development is *carrying capacity*. This is a well-established theme in the conservation literature that reaches back to Malthus. More recently it has taken on added utility with the interest shown by economists and statisticians in treating the environment as natural capital, and in devising accounting systems that measure its depletion. In this formulation, sustainable development may be defined as constancy of resource stocks and the ecological processes necessary to maintain their productive (source) and assimilative (sink) functions (Pearce, Barbier, and Markandya 1988). Within the context of regional ecosystems, this criterion will amount to no further net loss of natural capital or zero environmental damage netted across all development activities. Site-specific changes from exploitive development will thus require some compensation in the form of resource enhancement or environmental rehabilitation in other contingent areas (Sadler 1989b). In cases where an eco-region is already over-committed, it will be more appropriate to talk in terms of sustainable redevelopment (see the discussion by Regier in this volume).

In the calculus of sustainability, the relationship of development benefits and environmental risks are of critical concern (Jacobs 1986). The distribution of gains and losses associated with major projects is frequently skewed. A key question in this context is the extent to which sustainable development is more than equitable treatment and compensation of minorities who stand "in the way" of developments that are deemed to be in the broader public interest. Such concerns also focus attention on prior-order issues of project justification and the policy emphasis which should be given to economic activities that reinforce, rather than override, choice of lifestyle, local self-sufficiency, and community traditions, including those held by native peoples and others whose values are different from the urbanized mainstream of Canadian society (Sadler 1984; 1989a). Questions about the distribution as well as the consumption of natural capital thus lie at the nexus of sustainability and the debate about our common future.

[5] North-south differences, for example, take on a particular meaning in Canada as well as internationally. They are reflected in distinct environment-development pathways that incorporate different socio-economic values as well as increasing northward constraints imposed by a harsh climate and sensitive ecosystems, (i.e., slow rates of growth and recovery from damage). At the level of individual economic activity, sustainable forestry in one province may be narrowly interpreted as the capacity to harvest trees and in another as the capability to deliver a range of uses and benefits.

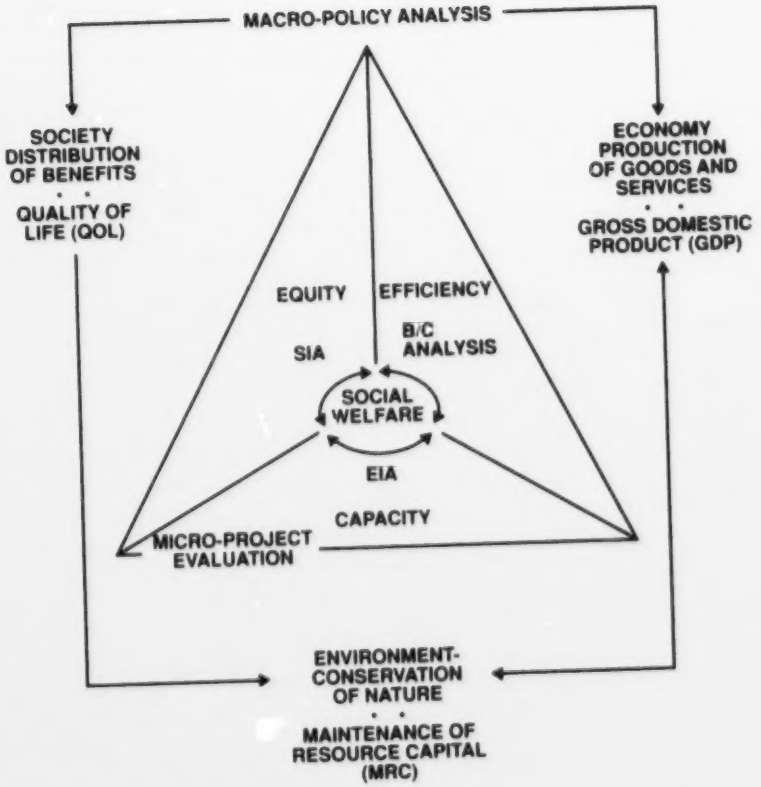

Figure 2. Decision-making for Sustainable Development: Criteria and Components. Source: Sadler (1990a)

Environmental Assessment and the Delivery of Sustainable Development

Environmental assessment and related procedures have been identified as key-mechanisms for translating the principles and criteria of sustainable development into strategy and action. We have already indicated that considerable improvement in the contemporary practice of EA is required for this promise to be realized. Existing concepts and approaches, fortunately, also contain a number of strengths and potentials that can be exploited to better advantage in planning and implementing sustainable development.

The structural problems associated with the place of EA in the larger framework of policy-making provides an entry point to consider other instrumental reforms that will be necessary to respond to the general recommendations made by the Brundtland Commission and the National Task Force for more integrated approaches to environmental management and development planning. At the project-specific level as well, the application of EA exemplifies many of the fundamental challenges associated with evaluating development and making informed choices. These include coping with uncertainty and risk, dealing with conflicts in interest and preference, coordinating scientific analysis and public inputs, and weighing facts and values in organizing information for decision-making. Environmental assessment, in microcosm, illustrates the rethinking and restructuring of the environment and development decision-making process that must take place in order to achieve the delivery of sustainable development.

EA Practice: Past and Present

The main phases in the evolution of environmental assessment in Canada are summarized in Table 1. For present purposes, the key point to note is the progressive expansion that has taken place in the role and scope of this process. Environmental assessment has shifted from a single-purpose focus on ecological prediction to a more multi-faceted approach to development planning and control that routinely includes social and risk analysis, impact management, and so on. In the process, the focus of practice has broadened from the methodology of impact analysis to encompass administrative and consultative procedures, and the strategic relationship and contribution of EA to policy and project decision-making. Each of these areas continues to be a theme for critical analysis of the capability of the process.

Table 1

Canadian and International Trends in Environmental Assessment and Review

Approximate Date	Innovations in Technique and Procedure
1. Pre-1970	Analytical techniques largely confined to economic and engineering feasibility studies; narrow emphasis on efficiency criteria and safety of life and property; no real opportunity for public review.
2. c. 1970	Multiple objective benefit-cost analysis; emphasis on systematic accounting of gains and losses and their distribution; reinforced through planning, programming and budgeting review; environmental and social consequences not formally incorporated.
3. c. 1970-1975	Environmental impact assessment (EIA), primarily focused on description and "prediction" of ecological/land use change; formal opportunities for public scrutiny and review established; emphasis on accountability and control of project design and mitigation.
4. c. 1975-1980	Multi-dimensional environmental assessment (EA) incorporating social impact assessment (SIA) of changes in community infrastructure, services, and lifestyle; public participation becomes integral part of project planning; increasing emphasis on project justification in review process; risk analysis of hazardous facilities and unproven technology in frontier areas.
5. c. 1980-1986	Attention given to establishing better linkages between impact assessment and policy-planning and implementation-management phases; research focus on effects monitoring, post-project audit and process evaluation; search begins for more disciplined scoping and focusing procedures and less protracted forms of consultation based on negotiation and mediation.
6. c. 1986-present	Scientific and institutional frameworks for environmental assessment, planning, and management begin to be re-thought and restructured in response to report of the Brundtland Commission and National Task Force on Environment and Economy; cumulative impacts of industrial and resource development on the global biosphere and regional ecosystems are new imperatives for policy reform and process adaptation; international aid agencies incorporate EA procedures into development planning and project appraisal.

Source: B. Sadler, "Future Directions for EIA," Paper prepared for 9th International Seminar on Environmental Impact Assessment, University of Aberdeen, 1988.

A recent series of EA audits and supporting case studies provide indicators of technical, consultative, and institutional performance (Sadler 1987).

1. The audits generally corroborate the findings of an earlier study of the scientific quality of EA (Beanlands and Duinker 1983), namely that analysis tends to be descriptive rather than predictive, lacking in rigour, unsupported by monitoring and follow up, and consequently falls short of its full utility for project management and

future sequences of planning and design. A more rigorous (read quantitative) approach to these matters takes us only so far in the view of some commentators because of the limitations placed on prediction by our understanding of ecological processes and systems. Holling's (1978) thesis of adaptive environmental assessment and management still remains the theoretical currency for science-based approaches.[6]

2. Public consultation in EA appears to have broadened in scope of opportunities and improved in effectiveness of application of traditional procedures (cf., Praxis 1988; Sadler 1980). Residual concerns remain about the effectiveness of public reviews and similar instruments on the part of both intervenors and proponents who are respectively concerned about fairness and efficiency. A trend towards the use of a range of lower-key, smaller-scale, less adversarial inform-and-involve procedures is noticeable outside the boundaries of formal public reviews.[7]

3. The so-called "main pattern" of EA traced by Wolf (1983) and others is being progressively redefined. It is now widely recognized that to function effectively this process must be supported by:

   i) A prior-order policy-planning framework to focus analysis and guide evaluation;

   ii) an implementation and management system for surveillance, monitoring, and control of actual as compared to predicted impacts; and

   iii) an audit and review capability for evaluating the lessons of experience and improving practice and procedures.

Where these components are absent or only partially in place, which is still often the case, the utility of the process for informed decision making and hence sustainable development is undermined (Cornford, O'Riordan, and Sadler 1985).

In the final analysis, the effectiveness of EA is difficult to determine in these terms. On the one hand, the preparation of EISs generates

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[6] On the social side, there is a more pronounced philosophical and methodological division over whether impact assessment should be a technical component of the planning process or a community development component of the political process (CEARC 1985).

[7] Environmental mediation and other alternative forms of dispute settlement are of considerable interest in this regard but still remain largely untried in Canada as compared to the United States (CEARC 1988a).

more technical data than we ever use (Jacobs 1984), and often appears to become an end in itself, a paper chase to win project approvals rather than a meaningful exercise in environmental planning and management (Sadler 1986). The paradoxes of impact prediction are that: a) it is typically reactive to the fact of project definition, and b) it is seldom related to the fact of subsequent, on-the-ground effects of project development. On the other hand, there is inferential and documented evidence that the EA process works to influence project design and policy adaptation and, more importantly, helps to shape the political culture of decision-making (Taylor 1984; Sadler 1990b). We have observed these impacts in our advisory work with various levels of government. Accordingly, we argue that the frame of reference for change and reform to EA, in support of sustainable development, should begin with a pragmatic extension and consolidation of existing trends in innovation rather than with the ideological and unilateral perspectives that often dominate critical analysis in this field.

Opening the Door to a Sustainable Future

A new view of EA is emerging. The operational and structural adjustments for making this process more adaptive and integrative can be pursued by accentuating present trends and supplementing them with other initiatives. For discussion purposes, we set out below possible directions for modifying, augmenting, and extending EA. These suggested improvements are collectively aimed at accelerating the shift from the traditional emphasis on impact minimization of project development to a more strategic approach. It attempts to maintain the regional integrity of natural systems while meeting the other social and economic imperatives of sustainable development.

Focus on Cumulative Impacts. The achievement of sustainable development requires a synoptic ecosystem approach, one that relates the dynamics of natural variability and the effects of human intervention to key indicators of biodiversity, productivity, and so on. Such a framework, based on the stress-response model, is incorporated in the organization of the *State of the Environment Report for Canada* (Bird and Rapport 1986). Environmental reporting provides the general baseline against which cumulative changes at the bio-regional level can be judged. The concept of cumulative effects, of the incremental reduction and erosion of the integrity of natural systems from the additive and compound interactions of multiple activities, provides a generic perspective for redirecting impact analysis to deal with the driving causes of unsustainable development (CEARC and

U.S. National Research Council 1986; CEARC 1988b). Cumulative analysis is one response to the structural inadequacy of the conventional project and site-specific application of the EA process. An explicit attempt to analyze and monitor cumulative changes within a regional or landscape system lends itself to the establishment of notional ecological thresholds or carrying capacities.

The scientific constraints on this adjustment are only beginning to receive serious attention. Shifting the time and space scales from conventional to cumulative impact analysis, for example, compounds the pervasive problems of complexity and uncertainty. Initial indications are that cumulative effects may be more tractable to landscape-level, risk-oriented analysis of fundamental properties than to acquiring and aggregating more and more information on more and more variables (cf., Preston and Bedford 1988; Lane *et al.* 1988). Further applied work on these approaches, now being supported by CEARC (1988b), must be underpinned by basic scientific research aimed at gaining a better understanding of the underlying processes (Science Council of Canada 1988).

Make the Process More Problem Focused and Value Based. Conventional EA tends to focus on a limited range of projects and activities. Many other development decisions and resource management practices escape any form of assessment, even though their collective impact may be greater than that of individual large-scale and hazardous facilities (Rees and Boothroyd 1987). Urban development is a classic example; it is characterized by a recurring perception that human settlements are somehow detached from their resource base and the imperatives of sustainability (Jacobs 1988). Class assessments of the kind undertaken in Ontario may yield an extended approach to identifying and mitigating cumulative effects. This approach should be supported and augmented by environmental and social impact monitoring and other control and evaluation procedures (Krawetz, MacDonald, and Nichols 1987; Munro, Bryant, and Matte-Baker 1987; Sadler 1988b). Whatever institutional arrangements are entertained to make EA more problem-focused, they should be explicitly geared to coping with the unexpected and learning from experience.

Such an emphasis on adaptive EA also coincides with longstanding concerns for making the process more responsive and user friendly, relevant to the dynamics of interest- and value-based conflict and to the terms in which local communities view development and its impacts. The equity proviso for sustainable development, striving to reduce the uneven distribution of benefits and costs, is manifest in

both technical and political approaches to social impact assessment (SIA) and public participation. A greater diversity of EA instruments should, in turn, open the door to creative experiments to empower communities and interests to assume greater responsibility for assessing, monitoring, and controlling development impacts and becoming involved in negotiated settlements of dispute (Rees and Boothroyd 1987; Sadler and Armour 1989). In this context, specific emphasis should be given to tapping the ecological and social knowledge that exists among native and rural peoples who follow traditional ecologies of resource use.

Move From React and Cure to Anticipate and Prevent. For the delivery of sustainable development, environmental considerations must be integrated into economic decisions at all levels. A broadening of EA to take account of more classes of activity only takes us so far. Even more crucial is the application of some type of systematic assessment to the highest levels of policy making. The Canada-United States Free Trade Agreement, for example, appeared to proceed with little or no serious review of its environmental implications. Policy and programmatic assessments of national and regional development proposals, which shape the economic future of Canada and the provinces, will probably need to take a different form from conventional project EA (Sadler 1990b).[8]

The research philosophy and themes being pursued by CEARC (1986) also underscore the importance of improving the application of existing procedures and achieving a more effective linkage among these at the operational level. Risk analysis, for example, has considerable potential for improving existing approaches to impact prediction and coping with uncertainty. It has particular applications in emerging areas for EA, such as the human health aspects of proposed developments (Davies 1988). As a domain of technology assessment, impact and risk analysis can also be used to scrutinize the introduction of new forms of technology, such as bio-engineering or the genetic manipulation of wild and domesticated species. The notion of sustainable *re*-development, introduced by Regier and Baskerville (1986), points to EA of damaged and degraded ecosystems for purposes of rehabilitation and restoration. These existing and emerging concerns will add new components and relationships to impact assessment and project evaluation of development proposals. Above all, however, the key to fostering a more anticipatory approach to EA involves placing this process within a more integrated system for environmental and economic decision-making.

[8] CEARC has recently commissioned a study of the environmental assessment of policies based on case studies of the energy, agricultural, and parks sectors.

Link Policy, Planning, and Assessment. In terms of the process of decision-making, the pursuit of sustainable development encompasses three critical phases (O'Riordan 1986). These deal with the justification, location, and mitigation of proposed activities. Project EA tends to focus largely on the latter area. As noted previously, however, the approach will work most effectively and efficiently when policy and planning processes are in place that deal with the first two areas of concern and so yield a coherent context for impact evaluation, development control, and learning from experience. Figure 3 outlines an integrated framework for environment and economic decision-making that builds and links together existing and emerging planning instruments. This framework, for example, identifies the possibilities for dovetailing the preparation of conservation strategies, now being pursued by the federal, provincial, and territorial governments, with the longer-standing focus on regional economic diversification. Ideally, both strategies should be designed and deployed as reciprocal blueprints for sustainable development.

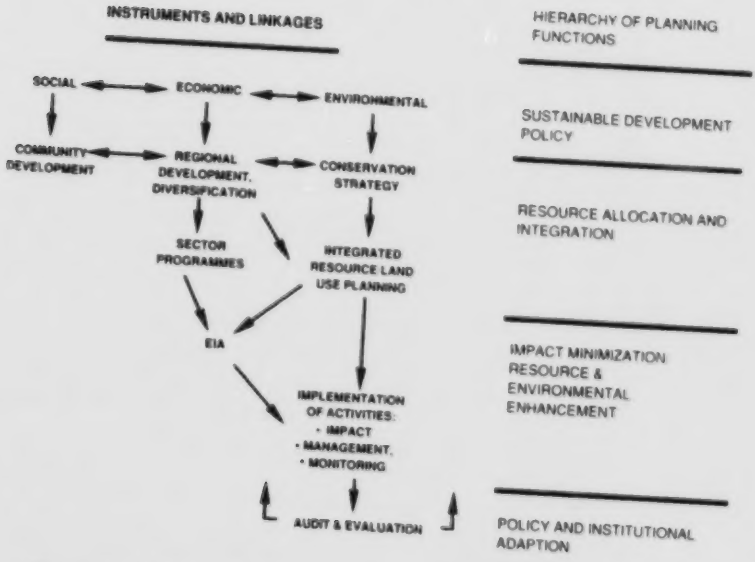

Figure 3. An Integrated Approach to Environment and Development Decision-making. Source: Sadler (1989c)

A similar approach may be envisaged when attempting to relate various human activities and sectoral developments to the different regional capacities represented by urban, rural, and natural landscape systems (Dorney 1985). Resource assessments, land capability mapping, and related procedures are helpful in supporting either attempts at integrated multiple-use planning or at efforts in agriculture, forest, and water management. Within this frame of reference, project EA, backed by monitoring and audit to track cumulative effects, can follow a more adaptive and proactive course to identifying, mitigating, and compensating for loss and change in natural capital. The generic approach illustrated in Figure 3 should not be thought of in bureaucratic terms as a comprehensive, monolithic system. Rather, it is a strategic orchestration of key policy, planning and assessment instruments flexibly deployed to the common purpose of achieving sustainable development (Sadler 1986; Jacobs 1986). Its practical applications, of course, will depend on what is already in place in federal and provincial systems and will emphasis different opportunities, including a certain degree of substitution between and across the different levels of decision-making. The time and effort directed to EA, for example, will reflect that put into integrated resource planning or into new forms of policy and programmatic assessment.

A Preliminary Agenda for Further Dialogue

The directions for change outlined above are meant to stimulate discussion on the relationship of EA and sustainable development. As a first step in that direction, CEARC commissioned essays and organized two round tables. The preliminary list of questions we developed for participants serves as a convenient framework for organizing the material in this volume.

What are the implications for decision-making of the mainstream concepts and principles of sustainable development? How does current theory and practice in environmental assessment, planning, and management reflect and support the notion of sustainability? Which frameworks and approaches show most promise in terms of meeting substantive and process criteria for sustainable development? Our introductory analysis emphasized the importance of an adaptive and integrated process of decision-making for achieving the economic, social, and environmental goals identified for sustainable development. A critical and comparative review of these generalizations is undertaken with reference to present EA-based approaches. Their relationship to sustainable development is here characterized as "nine blind men in search of the elephant" (Gardner). Further

commentaries on this metaphor and the supporting analysis are from the perspective of the scientist (Regier), the practitioner (Jakimchuck), and the environmental activist (Holtz). These Canadian views were supplemented by international perspectives solicited from colleagues respectively well-versed in the implementation of the principles of sustainable development (McNeely) and EA research and training (Clark).

What more specifically is involved in developing a more integrated process of environment and economic decision-making along the lines recommended by the Brundtland Commission and the National Task Force? What form might this marriage take in relationship to EA? And where does the promotion of social justice, of fairness and equity, fit into the scheme of things? There is plenty of room in the present discussion of whither sustainable development for radical perspectives on the conventional scientific and technological paradigm which governs our present approaches to problem-solving. With this in mind, there are three extended essays on the more fundamental ecological, societal, and philosophical questions associated with rethinking and restructuring EA in the context of sustainable development (Rees, Boothroyd, de Laet). It is evident from the brief exploration of recent paradigm shifts in science and management that sustainable development constitutes a new cloak for a well established but loosely integrated family of related ideas and interests. Modern environmentalism is characterized by a long-standing tension between what may be termed the technocentric and ecocentric approaches. One emphasizes management and control, the other stresses non-intervention and letting nature take its course. Environmental assessment as an important tool for achieving sustainable development is seen quite differently from these counter positions.

The next step involves encouraging dialogue on these themes. By making the material contained in this volume available to a wider audience, we hope to contribute to an ongoing discussion of ways and means of planning for sustainable development.

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Part I

Evaluation of Concepts and Methods

This section begins with a formal elaboration by Julia Gardner of the substantive goals of sustainable development. It addresses, as well, procedural criteria for judging the effectiveness of EA planning and management in achieving them. Gardner caricatures this relationship as that of the elephant and the nine blind men: sustainability is too complex a notion to be comprehended by any one approach to EA, itself a limited paradigm. The various strengths and weaknesses of the concepts and methods of impact assessment, monitoring and audit, whether applied discretely, sequentially or as part of a broader resource planning and management framework, are enumerated and compared.

Five supporting essays both qualify and extend this evaluation. Some of the papers take the form of critical commentary on Gardner's frame of reference (e.g., Clark); others use this as a point of departure for additional lines of analysis. For example, Henry Regier focuses on the ecological rehabilitation of degraded systems, in which environmental assessment might be employed to identify appropriate priorities, strategies, and actions.

This section underlines the fact that there is no one right approach to understanding the new animal of sustainable development, including both its ecological context and societal relationships. The emphasis instead must admit a plurality of approaches to augmenting and reinforcing the tool kit of concepts, methods, and techniques for analysis and problem-solving. Such a conclusion underlines the value of an adaptive, flexible strategy geared to feedback and learning.

The Elephant and the Nine Blind Men: An Initial Review of Environmental Assessment and Related Processes in Support of Sustainable Development

Julia E. Gardner

Introduction

A number of recent reports, notably those of the World Commission on Environment and Development (WCED) (1987) and the National Task Force on Environment and Economy (1987), call for the strengthening of tools and techniques for sustainable development and for a more integrated process of environment and development decision-making. It is in this context that the Canadian Environmental Assessment Research Council (CEARC) is reviewing the role and contribution of environmental assessment and related approaches. As a first step in this investigation, the Council commissioned an initial review of the potential of environmental assessment and related processes of planning and management for implementing sustainable development.[1]

This report focuses on three key questions:

- What does the concept of sustainable development imply for the decision-making processes of environmental assessment, planning, and management generally, and environmental impact assessment especially?
- How well do various approaches to decision-making currently support the principles of sustainable development?
- How can these approaches to management decision-making better support sustainable development?

One reader of a draft of this report drew an appropriate analogy between this search for understanding and the parable of the blind men and the elephant. In the first section of this paper, eight principles of sustainable development represent a first approximation

[1] Two workshops were held in Vancouver and Montreal to discuss an earlier version of the report. While some of the comments and suggestions contributed by participants at these workshops have been incorporated into this document, the responsibility for the views expressed herein remains with the author.

of a new animal. Next, nine approaches to environmental assessment are characterized as the blind men, and their descriptions of the animal (their support for the principles of sustainable development) are summarized. In the closing section, I look at the contribution of the combined wisdom of the nine approaches to the pursuit and understanding of sustainable development, and I point to the need for additional perspectives to complete the picture.

Perspectives and Principles of Sustainable Development

Sustainable development is a strategic approach to integrating conservation and development. The term was first brought to international attention by the International Union for the Conservation of Nature and Natural Resources (IUCN) in the World Conservation Strategy (1980). The Strategy states that sustainable development:

> *... must take account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long-term as well as the short-term advantages and disadvantages of alternative actions.*

The World Commission in Environment and Development (WCED) defined the concept more directly in its report (WCED 1987: 43):

> *sustainable development is ... development that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

The Canadian National Task Force on Environment and Economy (NTFEE) in responding to the WCED, or Brundtland report, adopted a similar interpretation of the term:

> *sustainable development is ... development that ensures that the utilization of resources and the environment today does not damage prospects for their use by future generations.*

The Task Force also drew on the World Conservation Strategy in calling for the preparation of conservation strategies as blueprints for sustainable development. Several provinces have completed conservation strategies or are in the process of drafting them. (See Canadian Society of Environmental Biologists (1987) for a synopsis of progress to date.)

Although the World Conservation Strategy, the Brundtland Report and the National Task Force on Environment and Economy Report have only recently begun to popularize the concept of sustainable development, the ideas they develop have well-established intellectual roots. In North America, notions of resource management and conservation, such as best use, wise use, and sustained yield, date back to the turn of the century. Concepts related and parallel to sustainable development, drawn from socio-economic theories, include appropriate technology (Schumaker 1973), the conserver society (Science Council of Canada 1977) and the ecological society (Bookchin 1980).

A number of conferences have been pivotal in the evolution of thinking about sustainable development. The idea of ecodevelopment emerged from the United Nations Conference on the Human Environment in Stockholm in 1972. This concept, since developed by Riddell (1981), Dasmann (1984) and Repetto (1985), is closely related to that of sustainable development. It is described by Sachs (1978) as:

> *... an approach to development aimed at harmonizing social and economic objectives with ecologically sound management, in a spirit of solidarity with future generations; based on the principle of self-reliance, satisfaction of basic needs, a new symbiosis of man and earth; another kind of qualitative growth, not zero growth, not negative growth.*

Almost 15 years after Stockholm, at the first World Conservation Strategy Conference in 1986, international experts again emphasized the need for continued development in harmony with environmental conservation, decrying the tendency of developed countries to focus on global conservation measures in isolation from the problems of underdevelopment (Jacobs and Munro 1987). Both internationally and within Canada, themes related to sustainable development have been supported and elaborated by various interests.

A new sense of social commitment and political responsibility characterizes the current dialogue on sustainable development. However, this dialogue also exemplifies the potential for widely varying interpretations and frustation surrounding the concept. Headlines in the Toronto *Globe and Mail*, for example, present sustainable development as "limitless growth" and "good business" (Keating 1988), while the WCED considers that it "aims to promote harmony among human beings, and between humanity and nature" (WCED 1987: 65).

The present discussion will attempt to clarify some questions and answers in its contribution to the sustainable development dialogue. It is intended to help move discussion toward a workable consensus, and reinforce higher level commitment to sustainable development. As a starting point, I have distilled from the literature referred to above eight main principles for sustainable development.[2]

The eight principles can also be interpreted as objectives, criteria, pre-conditions, desirable characteristics, components, parameters, or guidelines for sustainable development. In the following analysis, they are applied as premises that approaches to decision-making for resource management have to support, or at least not contravene, in order to steer a course toward sustainable development. The principles are divided into two categories: *substantive* and *process-oriented* (see Table 1). Substantive principles are value-oriented; they describe the ends of decision-making. These are the fundamental goals addressed by approaches to assessment, planning, and management for sustainable development. Process principles describe the structure, context, and processes of decision-making that are necessary to the pursuit of sustainable development.

Although this categorization of principles is not definitive, the successful pursuit of sustainable development certainly relies on a mixture of substantive and process-oriented considerations.

Substantive Principles in Achieving Sustainable Development

The first of the substantive principles is the *satisfaction of human needs* (Table 1: A). This principle embodies the precept that biological sustainability depends upon the sustenance of the human culture that determines the way resources are used. Growth is necessary for the satisfaction of needs related to energy, water, food, jobs, and sanitation (WCED 1987: 54-55); and generally for increased human wealth and well-being. However, because needs can only be met by conserving and enhancing the resource base, economic growth will have to be less material- and energy-intensive and more equitable in its impact (WCED 1987: 52-60). Qualitative forms of development will be at least as important as economic growth. Development as change will be appreciated for its role in maintaining

[2] Papers from the World Conservation Strategy Conference (Jacobs and Munro 1987) by Galtung; Halle and Furtado; Jacobs, Gardner and Munro; Khosla; Spitz; Sunkel; Walker; and Warford have contributed to the delineation of the principles although they are not cited in the text.

Table 1
Summary principles for framework assessment

The principles for sustainable development are summarized below. Each of the frameworks under review is assessed in terms of its adherence to these principles.

1. Ideology : *Goal-seeking*

Process-oriented
- 1a proactive, innovative, generates alternatives
- 1b considers range of alternatives and impacts
- 1c based on convergence of interests
- 1d normative, policy-oriented, priority-setting

Substantive
- A1 quality of life and security of livelihood
- B1 ecological processes and genetic diversity
- C1 equitable access to resources, costs and benefits
- D1 individual development and fulfillment, self-reliance

2. Analysis : *Relational*

Process-oriented
- 2a focused on key points of entry into a system
- 2b recognizing linkages between systems and dynamics
- 2c recognizing linkages within systems and dynamics
- 2d importance of spatial and temporal scales

Substantive
- A2 development as qualitative change
- B2 awareness of ecosystem requirements
- C2 equity and justice within and between generations
- D2 endogenous technology and ideas

3. Strategy : *Adaptive*

Process-oriented
- 3a experimental, learning, evolutionary, responsive
- 3b anticipatory, preventative, dealing with uncertainty
- 3c moderating, self-regulating, monitoring
- 3d maintaining diversity and options for resilience

Substantive
- A3 (growth for) meeting a range of human needs
- B3 maintenance, enhancement of ecosystems
- C3 avoid ecological limits and associated inequity
- D3 culturally-appropriate development

4. Organization : *Interactive*

Process-oriented
- 4a collaborative for the synthesis of solutions
- 3b integration of management processes
- 4c integration of societal, technical, and institutional interests
- 4d participatory and consultative

Substantive
- A4 organizations must respond to societal change
- B4 ecological principles guide decision-making
- C4 democratic, political decision-making
- D4 decision-making locally initiated, participatory

the resilience of organizations and their continued ability to meet human needs. In the literature on sustainable development cited above, only the Canadian Task Force report emphasizes economic growth over other forms of development.

The second substantive principle is *the maintenance of ecological integrity* (Table 1: B). This is the principle that encompasses the three goals of the World Conservation Strategy related to living resource conservation: maintaining essential ecological processes and life support systems; preserving genetic diversity; and ensuring the sustainable utilization of species and ecosystems (IUCN 1980). Adherence to this principle depends on staying within the limits of ecological carrying capacity by promoting ecologically realistic consumption standards and ensuring that ecological priorities are present in decision-making (National Task Force 1987: 6). Given that a large portion of the world's ecosystems are now degraded, attention must be paid to their restoration as well as preservation and maintenance.

The third substantive principle arises from a major topic of discussion at the World Conservation Strategy Conference in 1986 — *the achievement of equity and social justice* (Table 1: C). "Historical patterns of resource use repeatedly demonstrate the importance of commonality of interest and egalitarianism in environmentally prudent behavior" (Jacobs *et al.* 1987: 21). Achieving global equity will require the revival of economic growth in developing countries (WCED 1987: 49-52). Equity between generations depends on decision-making that takes into account the consequences of present actions on future living standards — a major theme in the sustainable development literature from Repetto (1985) to the National Task Force (1987).

The fourth substantive principle of sustainable development is *provision for social self-determination and cultural diversity* (Table 1: D). Although this principle dovetails with that of social justice, it is distinguished by its emphasis on self-reliance, individual development and fulfillment outside acquisitive materialism, and endogenous, culturally appropriate forms of development. The emphasis of social self-determination is on local or community initiative and control in decision-making. Experience has shown that central control cannot effectively tap the managerial capabilities of local communities or the potential for citizen initiative in promoting ecologically sound behaviour, especially on a voluntary basis. Government and planning intervention will, of course, still be necessary for the regulation of the private and corporate sectors.

Process-Oriented Principles in Achieving Sustainable Development

The first process-oriented principle requires that approaches to sustainable development be *goal-seeking*. This means that approaches seek pre-identified goals in a normative, proactive way, and also seek to identify new goals and policies or priorities that are consistent with principles of sustainability. Goal-seeking will thus ensure the pursuit of the substantive principles and their refinement and tailoring to specific situations. Motivation for action is taken beyond reaction, anticipation, or procedure to be positive, value-oriented, initiating, innovative, and alternative-generating. Decisions are based on the consideration of a wide range of options and a convergence of individual and societal interests.

The second process principle is that analytical approaches to sustainable development must be *relational or systems-oriented*. A systems-oriented approach focuses on the key points of entry into a system, the dynamics and linkages within and between systems, and the spatial and temporal context of decision-making. Awareness of interconnections between human and biophysical systems, or economics and environment, is integral to the sustainable development theme. Attention to spatial and temporal scale leads to a mix of solutions appropriate to the decision-making arena of concern, with full consideration of implications for other arenas, whether larger or smaller, sooner or later.

The third process principle is that strategies for sustainable development must be *adaptive*. Adaptive approaches manage risk through anticipation and prevention while seeking balance in human and natural systems through monitoring and self-regulation. Feedback and self-reflection facilitate an approach to management that is dynamic, responsive, evolutionary and iterative, facilitating experimentation and learning. Such an approach permits the seeking, testing, and redesigning of goals, and helps managers respond to surprise and discontinuous change in ways that promote sustainability. Resilience in the face of unexpected events also depends upon maintaining diversity or variety and conserving multiple options in human and biophysical systems.

The final process principle requires that organizational approaches to sustainable development be *interactive*. An interactive design for organization promotes trans-disciplinary collaboration among experts, the synthesis of strategies for management, and integration within and between management systems or sectors for strategy implementation. Participatory and consultative organizational

processes provide for the melding of socio-cultural, technical, and institutional interests and objectives in the goal-seeking process, so that decision-making fully takes into account both environmental and economic concerns. The National Task Force (1987: 6) refers to "a shared partnership of governments, industry, non-government organizations and the general public" which will "guide us through an integrated approach to environment and economy."

Each of these principles is a prerequisite to sustainable development. While some may conflict with one another in current practice, in the terms of sustainable development they are profoundly interdependent and they cannot be ordered by priority. "The elements of a program to promote sustainable development support each other and are attractive both environmentally and economically" (Repetto 1985: 15). Table 2 summarizes the relationship between process and substantive principles according to the decision-making categories: ideology, analysis, strategy, and organization.

The eight principles have been purposefully selected and defined in a broad-brush manner, without addressing specific technological, economic, or political prescriptions. More detailed treatment of the themes of sustainable development are undertaken in the discussions from which these principles have been distilled. The level of generality maintained here suits the purpose of reviewing approaches to environmental assessment. Assuming that the guidelines incorporated in these principles and approaches are sound, any detailed application that is consistent with them will promote progress toward sustainable development.

Approaches to Environmental Assessment, Planning, and Management

Nine approaches to decision-making for resource or environmental management will be reviewed here in terms of their support for sustainable development. All nine appear to be seeking a more adaptive or integrated approach to decision-making, at least partially reflecting the principles of sustainable development, and most of them are implicitly or explicitly critical of conventional approaches to environmental assessment, planning, and management. Three general types of approach are included. Progressing from the narrowest to the most general in application, they are:

Table 2
Relationships between principles for sustainable development and aspects of decision-making

N.B.: Code labels in cells correspond to codes in Table 1.

Aspects of Decision-making	**1 Ideology**	**2 Analysis**	**3 Strategy**	**4 Organization**
Process Principles				
	Goal-seeking	Relational	Adaptive	Interactive
	1a	2a	3a	4a
	1b	2b	3b	4b
	1c	2c	3c	4c
	1d	2d	3d	4d
Substantive Principles				
Human needs	A1	A2	A3	A4
Ecological integrity	B1	B2	B3	B4
Equity & justice	C1	C2	C3	C4
Self-determination	D1	D2	D3	D4

- *environmental impact assessment*, which focuses on the prediction and assessment of environmental impacts and the migitation of damage, usually taking a project-specific approach;

- *environmental assessment*, which attempts to understand interacting elements and processes of the environment including human activities for decision-making purposes, and is undertaken at various stages of management and planning; and

- *resource or environmental management and planning*, which aims to minimize environmental damage and optimize resource use through the direction and control of human activities.

The nine approaches to be discussed here are listed below, in order of progression through the spectrum from environmental impact assessment to environmental planning and management:

- ecological framework for environmental impact assessment;
- impact hypothesis;
- environmental impact assessment audits;
- cumulative effects assessment;
- bargaining in impact assessment, monitoring, and management;
- adaptive environmental assessment and management;
- sustainable redevelopment;
- impact zoning; and
- integrated management.

Because the nine approaches are designed to fill a range of functions, variations in their support of the principles of sustainable development are to be expected. Generally speaking, the broader the intended application of the framework, the more likely it is to reflect a wide range of principles. Nevertheless, it is useful to look at the approaches together in order to make the linkages between them and their relative roles more explicit.

The eight principles identified earlier are general, descriptive guidelines that prescribe a certain character for decision-making. They could apply to a wide range of approaches, and are not ingredients for the definition of a particular approach. Indeed, the

approaches reviewed here were certainly not designed with these specific principles in mind. The purpose of the present analysis is, therefore, not to judge the approaches, but to discover the extent to which they seem to support principles for sustainable development. The key question here is: What is the role of the nine approaches in contributing to the new perspective?

Sources of the nine frameworks referred to in the analysis are listed in this paper's reference section.

Ecological Framework for Environmental Impact Assessment

This framework encompasses Beanlands and Duinker's (1983) requirements for an improved approach to environmental impact assessment (EIA), based on their review of Canadian experience in EIA (see also Beanlands (1985) and Duinker (1985)). Beanlands and Duinker urge adherence to basic ecological concepts wherever possible, and a focus on "valued ecosystem components" in project decision-making. Their requirements overall are intended to promote the flexible application of a rigorous scientific approach to EIA.

Of the nine approaches, this one is closest to established approaches to EIA; it is accordingly less likely to promote the full range of the principles for sustainable development. Because its application is confined to the evaluation of individual project proposals, it cannot take a proactive stance. While societal priorities are an important reference point of valued ecosystem components, consideration of human systems is secondary to the focus on biophysical science and ecology. The objective is to predict and prevent environmental impacts, with less concern for resilience and responsiveness.

This framework pays little attention to the substantive principles; in keeping with the analytical, scientific perspective, normative judgements are avoided. Even ecological concepts, while central to the approach, are not expected to *drive* decision-making but to *compete* with non-ecological values. The utility of the ecological framework for EIA lies in its pursuit of predictive rigour, when applied in conjunction with more proactive and integrated approaches.

Impact Hypothesis

Environmental and Social Systems Analysis Ltd. has developed an approach to assessment based on the impact hypothesis, which is a statement describing the major biophysical and social processes that

connect development activities with potential environmental effects (Sonntag 1987; LGL Limited *et al.* 1984). This approach focuses on effects on valued ecosystem components, drawing directly from the work of Beanlands and Duinker (1983). The advantages of the impact hypothesis approach are that its impact predictions are explicitly stated, and it provides a common framework that facilitates comparison among projects. Although the approach essentially remains oriented to single project EIA, its stronger emphasis on adaptive strategies and relational rather than predictive analysis gives it a closer adherence to the process-oriented principles for sustainable development. If the impact hypothesis approach is used within more comprehensive frameworks, it holds considerable potential for contributing to sustainable development because of its recognition of the centrality of linkages between development activities and the biophysical environment.

Environmental Impact Assessment Audits

The review of this approach is based on "state-of-the-art review and evaluation of environmental impact assessment audits" by Munro *et al.* (1986). EIA audits can provide the factual basis for the examination and evaluation of the accuracy and utility of environmental impact statements, leading to increased effectiveness and efficiency of EIAs at the technical and administrative levels. They also have the potential to take the frame of reference for EIA beyond its traditional confines to meet a wider range of principles for sustainable development. While maintaining the bias toward improving the prediction of impacts, the audit can extend the role of EIA into the policy or goal-seeking sphere and enhance EIA as a learning experience. Munro *et al.* emphasize the importance of interactive organizational arrangements and capabilities in linking EIA to comprehensive planning. Even though a policy connection is made, however, the substantive principles of sustainable development are not directly supported.

Cumulative Effects Assessment

The review of cumulative effects assessment (CEA) presented here is based on work undertaken and commissioned by the Canadian Environmental Assessment Research Council (CEARC/U.S. NRC 1985; Sonntag *et al.* 1986; Peterson *et al.* 1986). Like impact assessment audits, CEA is a direct response to perceived deficiencies in conventional approaches to EIA. While maintaining an impact orientation, CEA should take EIA beyond the project level to program and policy-level concerns, broaden its spatial and temporal scope, and be more comprehensive and interdisciplinary, as well as

better integrated with impact monitoring and management systems. In making this transition, the approach opens itself to a larger selection of principles for sustainable development, including substantive ones. For instance, this approach directly addresses "quality of life" concerns and some normative aspects of organization for decision-making.

On the negative side, by implying the need for "massive centralized control" (Peterson *et al.* 1986: 31) to support the integration of complex institutional arrangements involved in the control of cumulative effects, the approach effectively precludes opportunities for locally-initiated decision-making. The CEARC/U.S. NRC (1986) review of cumulative effects assessment identifies a similar paradox: CEA may not be able to express conclusions in terms that are relevant to sectors of society that have different environmental values because of its tendency to deal with a net effect, a single end-result impacting on a single societal entity. Nevertheless, the innovations of this approach stand out for their promotion of principles that are skirted by most environmental assessment frameworks and ignored by its EIA predecessors. These include, for example, "forcing the analyst to be creative," "incorporating recent advances in goals-based planning," and confronting the possibility of structural changes in physical, social, and ecological systems.

Bargaining in Impact Assessment, Monitoring, and Management (IAMM)

This approach links EIA firmly to impact monitoring and management. According to Dorcey (1986) these processes can be enhanced through improved interaction between people in resolving issues and seeking agreement (see also Dorcey and Martin 1985). Dorcey's central theme is bargaining and negotiation in the resolution of conflicts involving scientific and social issues, usually in a project-specific context. Dorcey and others maintain that effective bargaining relies on appropriate information, representation, interaction skills, and structures.

IAMM, when focused on bargaining and negotiation, holds promise for supporting sustainable development through the pursuit of equitable decision-making practices, and by contributing practical directions for adhering more closely to principles of interaction and consultation in management. The approach also emphasizes that conflicts are inherent to the pursuit of sustainable development priorities, and their effects cannot be ignored.

Adaptive Environmental Assessment and Management (AEAM)

This approach differs from conventional EIA in its much broader application and in its emphasis on coping with uncertainty rather than improving predictability. Its aim is to integrate environmental with economic and social understanding throughout the environmental policy and design process, responding to the effects of management as it proceeds (Holling 1978; IIASA 1979). AEAM is based in the techniques of computer system modelling and systems analysis (see ESSA 1982; Holling 1986; Jones and Greig 1985; and Reiger 1985). The intellectual links between the authors of AEAM and those of cumulative effects assessment are implicit in the emphasis on certain principles that the approaches hold in common — in fact, CEA expressly uses AEAM approaches.

The AEAM approach supports all of the process-oriented principles for sustainable development. A major focus is on adaptive strategies, in which "learning becomes as much of a product as does problem-solving," resilience becomes more important than prevention, and objectives and designs are formulated to benefit from the unexpected. The notion of adaptation goes beyond strategy to prescribe integrative forms of organization, approaches to analysis that place priority on relations above data, and an ideology directed at the purposeful influencing of policy by AEAM processes. This latter priority permits the approach to support substantive principles of sustainable development through a prescriptive orientation. However, many substantive principles are still not explicitly supported, notably those related to equity and social justice.

Sustainable Redevelopment

This term, coined by Regier and Baskerville (1986), emphasizes the ecological rehabilitation of degraded natural environments and renewable resources. In contrast to AEAM, sustainable redevelopment adheres less strongly to the process-oriented principles but promotes the substantive principles more consistently than any other approach. Analysis of the framework here may be somewhat tautological because of its conceptual proximity to sustainable development, but the approach is worth looking at for its demonstration of the way the very language of sustainable development can be incorporated into practical approaches to decision-making for environmental planning and management. For example, Regier and Baskerville remind us that local control is a practical and ethical imperative ("act locally" while "thinking globally") and that a long-term perspective on development is essential.

The fact that sustainable redevelopment is somewhat less ambitious in its schemas for analysis and strategy than some of the more comprehensive frameworks may reflect its unique recognition of the trauma and the tension involved in ensuring the convergence of local management interventions with plans for global sustainability. Some sophistication of analysis, of the sort demonstrated by AEAM techniques, may have to be sacrificed so that "a well-functioning independent soft set of local allocative methods" is not destructively overridden (Regier and Baskerville 1986: 99).

Impact Zoning

This approach provides a framework to guide development decision-making that is based on the ecological concept of carrying capacity. Developed by Rees and Davis (1978), impact zoning would require the locating of development or projects in areas that had been predetermined as suitable for that use on the grounds of biophysical capability (see also Rees 1981).

This approach returns us to the emphasis on broader-scale integration of management across administrative sectors at the regional level. This emphasis is characteristic of process-oriented approaches to assessment, planning, and management such as IAMM. The tension between central control and local initiative identified previously is resolved by conceptualizing impact zoning as a positive framework for regulation that is supplemented by creative negotiation and performance monitoring. Yet the approach does not clarify how zoning can be both firm enough to play a fail-safe role in ecosystem maintenance and flexible enough to "respond to changing values, perceptions, knowledge and economic realities, as community development proceeds" (Rees 1981: 32).

The impact zoning approach is notable for its consistent and explicit adherence to the substantive principle of maintaining ecological integrity. Where other approaches waver in their commitment to the recognition of ecological constraints on development as a "bottom line" for decision-making, impact zoning is founded on a systems definition of carrying capacity and the awareness of humankind's dependency on the biological productivity of ecosystem resources. Implied compromises in the freedom of locally-initiated decision-making may be ethically justified by this model's support for the principle of equity *between generations* — a principle that is not explicit in any other framework.

Integrated Resource Management (IRM)

This is a strategic, interactive approach to management that attempts to bring a wider range of needs and values into the decision-making process (Lang 1986) and to deal with planning, assessment, and implementation in concert (Cornford, O'Riordan, and Sadler 1985). It also addresses some of the central themes of approaches discussed above, such as uncertainty and cumulative effects.

Approaches to IRM focus, as the name indicates, on the principles of integration for all aspects of resource assessment, planning, and management. The approach also supports other process-oriented principles for sustainable development: IRM is explicitly proactive, consultative, integrating, coordinating, focused, and adaptive (Sadler 1986). Emphasis on ecosystem maintenance, social priorities for resource use, and the devolution of responsibilities to communities suggests support for substantive principles as well.

At first glance, IRM may appear to be the "gilt-edged approach." However, experience with other frameworks suggests a more cautious evaluation. Like AEAM, IRM adheres to virtually every process-oriented principle but is less committed to the substantive principles, none of which is strongly emphasized. While it may be argued that a low level of support for many substantive principles is the integrative solution to conflicting priorities, the sustainable redevelopment and impact zoning frameworks have suggested that a reasonable level of *commitment* to substantive principles is required for sustainable development, and that adherence to process-oriented principles cannot be expected automatically to engender such commitment. Indeed, a low level of commitment to a wide range of principles may serve to obscure the difficulties, tensions, or challenges posed by the simultaneous but continually shifting demands of a diverse set of requirements for sustainable development.

Notwithstanding these caveats, IRM must be acknowledged as one of the most promising approaches to decision-making for sustainable development, because of its wide-ranging support for the eight principles.

Support for Sustainable Development in Approaches to Environmental Assessment, Planning, and Management

The previous review of the nine approaches has pointed to certain patterns in support for the different types of principles for sustainable

development. Overall, process-oriented principles were better supported than were substantive principles, and, as expected, the more comprehensive approaches supported more of the principles. A summary of the analysis is found in Tables 3, 4, and 5.

Of the *process-oriented principles*, those related to systems analysis and adaptive strategies received the most attention in the narrower, EIA frameworks. Goal-seeking and interactive organizational principles took on a higher profile in the broader approaches. Less than half of the approaches placed any emphasis on the *goal-seeking* aspect of process, possibly reflecting an assumption that resource management goals and priorities should be set by policy-makers rather than by those who undertake planning and management for implementation. Approaches that did place a priority on goal-seeking stressed the proactive themes of creativity, initiative, and implementation. AEAM, for instance, suggests that designs that work with natural forces provide the opportunity for the enhancement of natural systems, and not just their protection.

Systems or relational principles were supported by all the approaches, emphasizing the characterization of specific ecosystems under threat of impact. Fewer approaches thoroughly addressed the nature of human systems and their interaction with biophysical ones, as required for sustainable development. While all frameworks recognized the need to consider *spatial and temporal scales*, this was often to set boundaries on studies rather than to identify interconnections between occurrences at different time and geographical horizons. Similarly, *focusing* in assessment systems was justified more in terms of efficiency than to enhance the sustainable development priorities for learning and problem-solving.

The *adaptive* principle was also subject to wide variations in interpretation. Most approaches emphasized reducing *uncertainty* through better science and forecasting techniques while some stressed the inevitability of unexpected events and the need to be prepared for these by maintaining diversity and *resilience* in systems. One area of consensus on the theme of adaptation was in the area of *learning* and experimentation. *Monitoring* and the collection of baseline data are now recognized as being as crucial to the accumulation of understanding and experience as they are to the ongoing regulation of projects and mitigation of impacts. The impact hypothesis framework centers on this priority. This emphasis on learning has the potential to enhance support for virtually all the principles of sustainable development, as experience proves their worth.

Table 3
Adherence to process principles for sustainable development by frameworks (codes correspond to Table 1)

Adherence Ranking Code	X antithetical — implied against 0 neutral			? indeterminate		+ implied	# explicit		* high priority
Framework Type	Environmental Impact Assessment			Environmental Assessment			Environmental Planning and Management		
Framework Name	Ecological Framework for EIA	Impact Hypothesis	EIA Audits	Cumulative Effects Assessment	IAMM	AEAM	Sustainable Redevel-opment	Impact Zoning	Integrated Resource Management
Principles									
Goal-seeking	?/#	0/#	0/#	+/*	O/+	*	O/*	#	+/*
1a	0/#	0	0	*	#	*	*	#	*
1b	?	0	0	#	0	*	0	#	+
1c	#	#	#	#	#	*	+	#	*
1d	0/#	+	#	+	#	*	#	#	*
Relational	0/*	#/*	0/#	#/*	0/*	#/*	0/*	#/*	#/*
2a	*	*	#	#	*	*	0	#	*
2b	0	#	0	*	0	#	#	#	#
2c	*	*	#	*	0	*	#	*	#
2d	#	#	#	*	#	#	*	#	#
Adaptive	-/*	0/*	0/*	#/*	0/#	*	#	#/*	#/*
3a	#	*	#	#	#	*	#	*	*
3b	-/*	#	#	*	#	*	#	*	*
3c	#	#	*	*	#	*	#	*	*
3d	#	0	0	#	0	*	#	#	#
Interactive	0/#	0/#	+/*	#/*	#/*	#/*	0/#	+/*	*
4a	#	#	*	*	*	*	#	+	*
4b	0	0	*	*	#	#	#	*	*
4c	#	0	+	*	*	*	0	#	*
4d	#	0	#	#	*	*	#	#	*

Table 4
Adherence to substantive principles for sustainable development by frameworks; principles listed by decision-making category (codes correspond to Table 1)

Adherence Ranking Code	X antithetical — implied against 0 neutral			? indeterminate		+ implied	# explicit		* high priority
Framework Type	Environmental Impact Assessment			Environmental Assessment			Environmental Planning and Management		
Framework Name	Ecological Framework for EIA	Impact Hypothesis	EIA Audits	Cumulative Effects Assessment	IAMM	AEAM	Sustainable Redevel-opment	Impact Zoning	Integrated Resource Management
Principles									
Ideology	?/+	0/+	0/#	0/*	0/+	0/#	0/#	0/*	0/#
A1	+	+	#	*	+	0	+	0	#
B1	+	0	+	#	0	#	+	*	#
C1	?	0	0	0	+	0	#	+	#
D1	0	0	0	#	0	0	0	0	0
Analysis	-/*	0/#	0/#	-/+	0	0/#	0/#	?/*	+/#
A2	0	0	0	0	0	+	#	#	
B2	*	#	#	+	0	#	#	*	#
C2	0	0	0	0	0	0	0	*	+
D2	—	0	0	—	0	#	#	?	+
Strategy	+/#	0/+	0/#	-/#	0	0/#	0/#	0/*	0/#
A3	#	0	0	0	0	#	#	+	+
B3	+	+	#	#	0	#	#	*	#
C3	+	0	0	0	0	0	0	0	0
D3	+	0	0	—	0	+	#	0	+
Organization	-/+	0	-/+	x/#	0/#	?/*	#/*	?/*	+/#
A4	+	0	0	#	0	*	#	*	+
B4	#	0	+	#	0	+	#	*	+
C4	?	0	?	#	#	?	#	#	#
D4	—	0	—	x	+	#	*	?	#

Table 5
Adherence to substantive principles for sustainable development by frameworks; principles listed by type of principle (codes correspond to Table 1)

Adherence Ranking Code	X antithetical — implied against 0 neutral			? indeterminate		+ implied	# explicit	* high priority	
Framework Type	Environmental Impact Assessment			Environmental Assessment			Environmental Planning and Management		
Framework Name	Ecological Framework for EIA	Impact Hypothesis	EIA Audits	Cumulative Effects Assessment	IAMM	AEAM	Sustainable Redevel-opment	Impact Zoning	Integrated Resource Management
Principles									
Human Needs	0/#	0/+	0/#	0/*	0/+	0/*	+/#	0/*	+/#
A1	+	+	#	*	+	0	+	0	#
A2	0	0	0	0	0	+	#	#	+
A3	#	0	0	0	0	#	#	+	+
A4	+	0	0	#	0	*	#	*	+
Ecological Integrity	+/*	0/#	+/#	+/#	0	+/#	+/#	*	+/#
B1	+	0	+	#	0	#	+	*	#
B	*	#	#	+	0	#	#	*	#
B3	+	+	#	#	0	#	#	*	#
B4	#	0	+	#	0	+	#	*	+
Equity & Justice	?/+	0	?/0	0/#	0/#	?/0	0/#	0/*	0/#
C1	?	0	0	0	+	0	#	+	#
C2	0	0	0	0	0	0	0	*	+
C3	+	0	0	0	0	0	0	0	0
C4	?	0	?	#	#	?	#	#	#
Self— Determination	-/+	0	-/0	x/#	0/+	0/#	0/*	?/0	0/#
D1	0	0	0	#	0	0	0	0	0
D2	—	0	0	—	0	#	#	?	+
D3	+	0	0	—	0	+	#	0	+
D4	—	0	—	x	+	#	*	?	#

Support for the *interactive* principle increased dramatically through the progression of frameworks from EIA to comprehensive planning and management approaches. *Collaboration, consultation,* and *participation* are increasingly appreciated as processes for improving both technical and regulatory control over the impacts of development, through agreement on objectives and appropriate approaches. Some approaches stressed the need to improve *communication.* Several looked to *institutional integration* for the coordination of management activities. This latter focus sometimes implied a highly centralized approach to control over resource use.

Fewer patterns are observable in support for substantive principles. Ecological integrity was the main substantive priority reflected in the approaches, with the more anthropocentric principles being relatively neglected. As with the process-oriented principles, the more comprehensive approaches generally reflected a higher level of support.

The overall low level of support for the substantive principles could have a number of origins. The authors, for example, may have assumed that the process-oriented principles upon which the frameworks are based would automatically lead to the promotion of the substantive principles of sustainable development. As mentioned above, the analysis does not bear this out.

Differences in levels of support for the eight principles of sustainable development point to a difficulty in meeting all of them simultaneously. This is related to tensions and even paradoxes in the design of approaches to management that will direct us toward sustainable development. These tensions usually arise from variability in complementarity among principles at different levels or scales of application, as described by Regier and Baskerville in the context of sustainable redevelopment. The more comprehensive approaches like IRM are able to support a broad range of principles in part because their high level of abstraction removes them from the consideration of the conflicts that are encountered in dealing with multiple needs and levels of management simultaneously. Process-oriented approaches, like bargaining for IAMM, which confront the challenge of conflict resolution, provide no substantive guidelines as to the range of resolutions that would be acceptable in terms of sustainability. Assessment-oriented approaches like CEA or impact zoning support certain substantive principles — usually ecological ones, but in the process they jeopardize support for others — usually those associated with local control and self-determination.

The dilemma posed by this apparent exclusivity among principles brings us back to the question: What kind of animal is sustainable development? Although the form of the animal is difficult to distinguish, it is definitely substantial, and its parts are something akin to the eight principles first defined. The catch is that all eight parts must be healthy and functioning simultaneously. The men — the nine approaches — would generally recognize the sustainable development animal if they were to combine their efforts. Reaching *beyond* these approaches, we can find some additional ingredients elsewhere. In concluding, I will summarize the ingredients provided by the nine approaches reviewed here and suggest some alternative approaches to locate the missing parts.

Further Directions for Analysis and Discussion

The approaches to environmental assessment, planning, and management reviewed here are well advanced in incorporating principles for sustainable development in the areas of goal-seeking, and relational, adaptive, and interactive processes; several of them also support principles of environmental integrity. Even traditional EIA, especially when strengthened and focused by the "ecological framework," plays an essential role in fostering awareness of the environmental consequences of development activities and of the tradeoffs involved. A more flexible and widely applied approach to EIA could extend these benefits to other phases and other levels of decision-making. But to overcome the constraints of the narrowness and the purely reactive nature of EIA, the approach must be used in conjunction with other approaches, as follows.

Explicit testing of impact hypotheses and cumulative effects assessment injects a more systemic and longer-term perspective into EIA, and audits of the processes encourage more of a learning approach and policy orientation. Bargaining and negotiation ensure the representation of different interests, including the community, in decision-making processes that go beyond EIA to impact monitoring and management. Adaptive environmental assessment and management and impact zoning provide tools for a more proactive or goal-seeking approach, knitting together ecological and development priorities. Sustainable redevelopment recognizes that we are often not starting with the conditions that we would wish, and it provides an approach for moving towards sustainability that takes into account the problems of acting locally in an environmentally sensitive way. Finally, integrated resource management frames decision-making as a truly interactive and multipartite approach that conceivably could provide a context for all of the other approaches.

Regardless of the promise of the combined wisdom of the nine blind men, a substantive part of the sustainable development animal is still neglected. The approaches reviewed, with the exception of sustainable redevelopment, pay little direct or explicit attention to the satisfaction of human needs, the achievement of equity and social justice, and provision for social self-determination and cultural diversity. The missing components may be found in alternatives such as bioregionalism, deep ecology, ecosystem peoples or traditional native cultures, community-based development, co-management of common property resources, and land trusts. These alternative approaches are "softer" in the sense that their progenitors are less likely to be professionals; they come from communities rather than institutions. The derivation of these approaches is also likely to be more experiential than scientific, with methods rooted in feelings and world views as much as in scientific rigour. These approaches do not shy away from the consideration of values and the pursuit of ideals like cultural reform, peace, human rights, the inherent worth of nature, and an end to poverty.

A wealth of experience in progress towards sustainable development through these alternative approaches to environmental management remains to be tapped. I expect it will shed light on substantive components of sustainable development that most of the blind men have been missing. Yet, while the experience of the alternative approaches beckons, the efforts of the present report could be enhanced on a more modest scale. If the approaches examined here are to offer the fullest support for sustainable development, they should be analyzed within their operational context, going beyond the predominantly theoretical viewpoint of this study. In other words, the promise for support of sustainable development identified here needs to be confirmed by a review of multiple applications of the approaches, and by ongoing testing of them against the principles for sustainable development. In the process, the principles themselves will also be explored and tested, so that we become ever more familiar with the new animal.

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A Focus on Reform and on Redevelopment of Degraded Regions

Henry A. Regier

Introduction

This paper complements the background discussion prepared by Julia Gardner. Her paper reviews the theme of "sustainable redevelopment," as sketched by Regier and Baskerville (1986). She correctly infers that Gordon Baskerville and I did not attempt to develop a comprehensive framework for environmental assessment or management. Rather we emphasized some substantive issues — "sustainable redevelopment of degraded regions" and "think globally and act locally" — as requested by the conveners of the 1984 Symposium on Sustainable Development of the Biosphere (Clark and Munn 1986).

The concept and process of sustainable redevelopment was further elaborated at a conference on Ecosystem Redevelopment in Budapest in April 1987 convened by Academician Istvan Lang of Hungary (a member of G.H. Brundtland's World Commission on Environment and Development (WCED)). A collation of all submitted papers is available from the UNESCO Man and the Biosphere (MAB) Program (Dyer 1987). *Ambio* published a special issue of selected papers from this symposium (Rosemarin 1988). The Cambridge University Press may publish another compendium of some symposium papers (Regier, Toth, and White, in preparation).

With these more recent developments, some or all of the entries shown as "implied" or "neutral" for sustainable redevelopment in Table 3 of Gardner's paper could now be updated to read "explicit." But we still have not attempted to produce an explicit framework, as such. Our broader agenda is "cultural reform" and it would be a bit presumptuous to propose a framework for that. Within cultural reform, sustainable redevelopment should be a major policy for regions now suffering bad consequences of "conventional exploitative development" (Figure 1).

The IUCN's 1980 World Conservation Strategy and the principles of the WCED (1987) do not deal effectively, in my opinion, with the problem of the massive regional degradation that already exists as a consequence of conventional exploitative development. This inadequacy is reflected in Gardner's "summary principles for

framework assessment" (see her Table 1). However, UNESCO-MAB is attempting to correct this inadequacy within its program (Regier and Francis 1986).

For degraded developed regions of the world, "sustainable development" must come to mean "cultural reform and sustainable redevelopment." "Sustainable development" can have little in common with conventional exploitative development. With reform and redevelopment — at local, regional, and global levels — we should:

- seek to reverse the major abuses of the past and present;
- foster ecosystemic recovery even in the face of growing abuses, e.g., as related to biospheric contamination and climate change;
- initiate new practices, e.g., clean technology and ecosystem husbandry, to take the place of degrading techniques;
- adapt as best we can to the irrevocable evils among the consequences of current and past development, e.g., by zoning contaminated locales as unsafe indefinitely into the future; and
- know that some major natural and cultural phenomena of the future are and will remain unpredictable, hence prudence will remain a virtue.

What is the relevance of all this to "environmental assessment"? From now on assessments of proposals for developments in degraded regions should relate to the substantive objectives and procedural strategies of reform and redevelopment. It is not sufficient that an assessment relate simply to present debased realities, it must relate primarily to legitimate expectations. Will the proposed development fit into the policy of reform? Will it slow down or even reverse the rate of ecosystemic recovery from past abuse? Will it threaten the achievement of redevelopment objectives?

Sustainable Redevelopment in the Great Lakes Basin

As a result of about a century of conventional exploitative development, the southern third of the Great Lakes Basin had become a vast ecological slum by the 1950s (Regier 1986). Binational efforts to reverse the effects of this "slumification" within the Great Lakes themselves occurred in several steps: the Great Lakes Fishery Convention (GLFC) of 1955 to control sea lamprey and reverse

overfishing; the 1972 Great Lakes Water Quality Agreement (GLWQA) to reverse eutrophication and conventional toxic loadings; the 1978 GLWQA to reverse chemical contamination; and other compatible agreements at the state and provincial level (National Research Council/Royal Society of Canada (NRC/RSC) 1985; Francis 1986).

Under the GLFC, fish community goals for each lake were made public in 1988. Under the GLWQA, an ecosystemic goal has been formally incorporated into the Agreement for Lake Superior (in the amending protocol of November 1987) and a comparable goal will (according to formal commitments in the 1987 protocol) be accepted as the relevant information becomes available, which may happen by 1990. For each of the 42 degraded areas of concern in inshore waters, Remedial Action Plans are under development in which rehabilitative objectives and schedules are being specified.

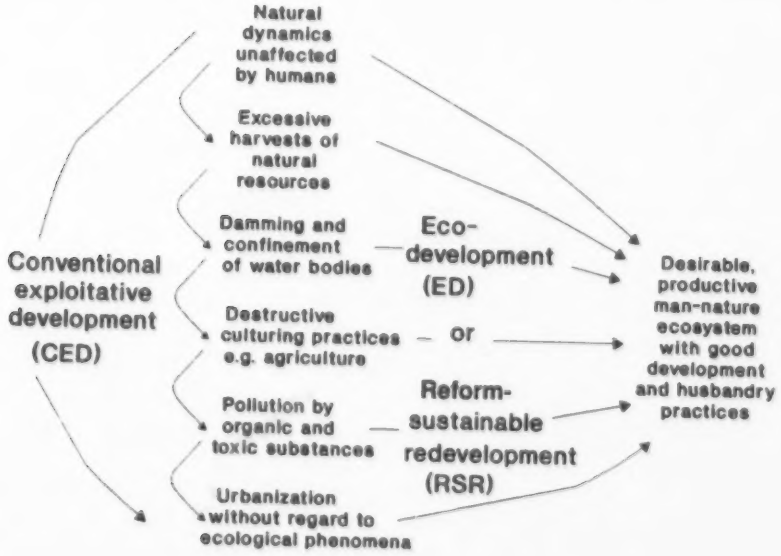
Natural dynamics unaffected by humans
Excessive harvests of natural resources
Damming and confinement of water bodies
Destructive culturing practices e.g. agriculture
Pollution by organic and toxic substances
Urbanization without regard to ecological phenomena
Conventional exploitative development (CED)
Eco-development (ED)
or
Reform-sustainable redevelopment (RSR)
Desirable, productive man-nature ecosystem with good development and husbandry practices

Figure 1. Schema to illustrate the meaning of major policy options "Sustainable development" must mean "eco-development" and/or "reform sustainable redevelopment."

It may be noted that the purpose of the 1978 GLWQA reads "... to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin ecosystem." The term "integrity" is not defined explicitly: it may have come into this Agreement via Aldo Leopold's land ethic: "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise" (Leopold 1948). Under the joint auspices of the commissions helping to implement GLWQA and GLFC, we are now trying to clarify the meaning of "integrity" taking into consideration earlier work on this issue (e.g., EPA 1977).

Environmental assessment of any major initiative in the Great Lakes Basin should address the formal binational commitments now in place. Though national constitutional law may not parallel international law closely, as in the United States today, the public forces that are driving these binational agreements are such that these reforms are unlikely to be denied. Hence any environmental assessment must be related to the process and goals of these reforms.

Balanced Information Services

Any boxes-and-arrows diagram of an organization's decision-making structure and process contains components related to information services or "intelligence." Figure 2 is a simplified sketch of such diagrams, here distorted to permit emphasis on balanced information services as a subsystem of the larger organizational system.

As it applies to a government agency, the central triangle of Figure 2 contains the relevant senior politicians, civil servants, regulatory and law-enforcement people, as well as the people being "managed." The information system is shown here as three interlinked balloons, each of which represents a primary and different function. Each information function "feeds" on the others, predominantly as shown by the arrows.

Reliable information is based on valid understanding derived from proper scientific research. This conventional wisdom will go unchallenged here and hence we can take the research function as a starting point.

Research on the real living world, in its state of being and becoming, should place roughly equal emphasis on three inter-related activities: mapping, monitoring, and modelling. This generalization applies to the cultural anthropological as well as to the natural ecological aspects of the living world.

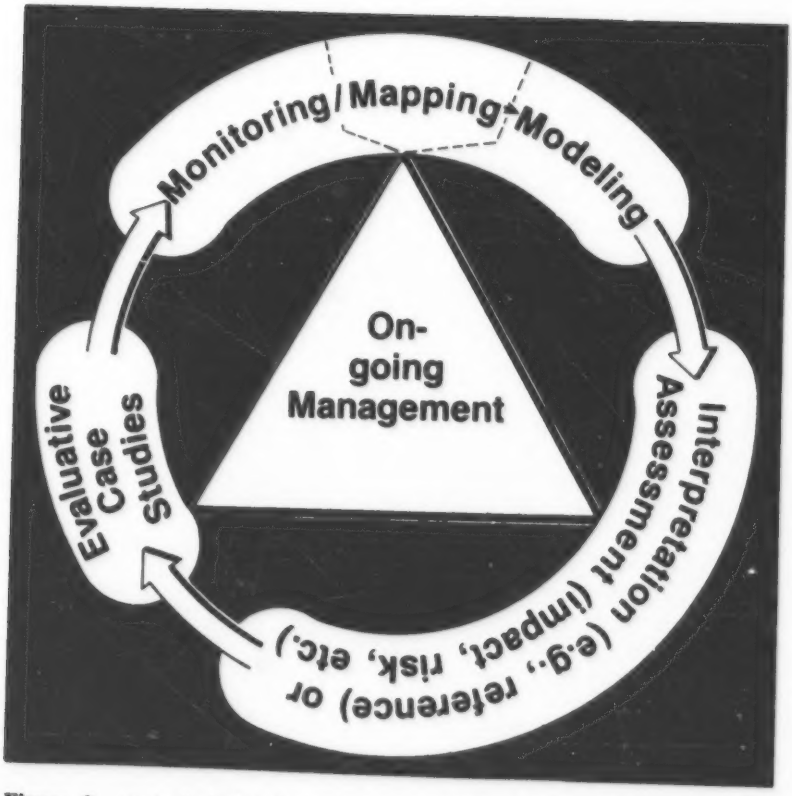

Figure 2. A technical information system for experimental management (from Haug *et al.* 1986).

Modelling seeks to interrelate data obtained from monitoring and mapping of a number of phenomena that appear to have some causal interconnections of special importance. Modelling also draws upon results of experiments in which researchers use simplified microcosms of the real world to test hypotheses concerning causality. Experimental results with microcosms demonstrate what can happen in the real world of macrocosms; modelling of real world phenomena seeks to determine what does happen.

The main route by which insight and information from research enters into the management process is through assemblers, planners, interpreters, and assessors — the second balloon in Figure 2. The information will be organized quite deliberately in a form thought to be directly relevant to the interests and needs of management and of the people "managed." The packagers and communicators need to be well-informed on what researchers have to offer and what would serve management and the public. This function is sometimes called "transfer science," which may be an abbreviation of "transfer of scientific information into a management setting." Generally the information will be in the form of map indicators and indices that contain much of the more relevant information available within the researchers' more complicated data series and maps and within their more intricate models and inferences. To be successful within the "science transfer" function, the packagers and communicators will need to iterate between perceptive experts within management and within research.

Planners and assessors have a key role to play in helping to organize the flow of insight and information from researchers to managers, but also in helping to put in place the evaluation function — the third balloon in Figure 2. "Evaluation" may occur as a program review or audit, a hearing by a legislative committee, a commission of enquiry, a court action, etc.

Where evaluation is done regularly, and not in a crisis mode, management may rely on appropriate "performance indicators" that are based on data collected routinely. The appropriate indicators and indices are based on managers' expectations of the consequences of actions taken on researchers' insights on how the natural-cultural system will respond to such action. As with a formal scientific experiment, the more precise the specification of the goal or expected result of the action, the more rigorous can be the evaluation of success or failure.

In cases where a proposed development raises difficult political issues, or an existing program has caused serious problems, a major

assessment or evaluation may be undertaken. Much more information may be demanded than is available in the form of routinely collected performance indicators. Intensive program-oriented research may be conducted over a year or two, perhaps by a private consulting firm with authority to access the organization's researchers and information. Some new information will be collected. The various kinds of information will be analyzed and packaged using statistical methods, simulation models, Delphi processes, and so forth.

It should now be apparent that all of the foregoing amounts to an elaboration of a meaning of "experimental management." The assessment function is emerging with a major role in balanced information services. But the relative importance of assessment should not be exaggerated.

Stress Response Ecology

Some 20 years ago, we began our ecological studies of the "pathology of ecosystems degraded as a result of cultural stresses" (Regier *et al.* 1969; Loftus and Regier 1972; Regier and Henderson 1973; Rapport *et al.* 1985, etc.). George Woodwell, Eugene Odum, Ramon Margalef and others also began related studies in the 1960s. We found that multi-stressed ecosystems tended to exhibit degradation syndromes with synergism among the consequences of different stresses. A variety of stresses acting separately and jointly could and did trigger somewhat similar symptoms, hence diagnosis of the cause of degradation was quite difficult. Such synergism is, of course, of relevance to environmental assessment of a new stress or of intensification of existing stresses.

The difficulty with diagnosis and prognosis was compounded by the structure and dynamics of specialization among the researchers, planners, and managers. Each type of cultural stress had its own coterie of experts who benefited professionally from the identification of that particular stress as of primary importance in some particular instance of degradation. To counter the generation of such self-serving noise, we began, 10 years ago, to develop an interdisciplinary "level playing-field" or process in which all experts had equitable access to the issue with fair rules of play (Francis *et al.* 1979; Lee *et al.* 1982). This process has come to be incorporated into the Remedial Action Planning process for the 42 areas of concern with leadership through example by experts on the Green Bay area of concern (Harris *et al.* 1982; Harris *et al.* 1987).

We have since attempted to expand the scale of interdisciplinary stress-response ecology to the basin level, by undertaking comparative

study of the Baltic and Great Lakes Basins (Harris *et al.* 1987; Muir *et al.* 1987; Francis 1988). Throughout, the focus has been on sustainable redevelopment, and the emphasis has been both on substance and on process.

Harsh Incisive Science and Holistic Eco-related Studies

In her background paper, Gardner notes that the sketch of sustainable redevelopment by Regier and Baskerville (1986) "may reflect...the trauma and the tension involved in ensuring the convergence of local management interventions with plans for global sustainability. Some sophistication of analysis, of the sort demonstrated by AEAM techniques, may have to be sacrificed so that a 'well-functioning soft set of local allocative methods' is not destructively overridden." In a way, the concepts and methods of our sustainable redevelopment bridge both the analytical AEAM techniques of Holling and colleagues, as well as the negotiative techniques of Dorcey and colleagues (see appropriate references in Gardner). Our approach may be somewhat dialectical in that it recognizes the existence or action of opposing social forces.

This dialectic evokes such analogues as:

- husbandry and exploitation,
- mutual aid and mutual competition,
- right-brained and left-brained,
- holistic synthesis and reductionistic analysis,
- Gemeinschaft and Gesellschaft,
- yin and yang,
- ecocentric and technocentric,
- lateral diffuse authority and vertical centralized authority,
- soft core and hard shell (as in Figure 3), and
- holistic eco-related studies (HERS) and harsh incisive sciences (HIS).

Of course, reality is too complex to be characterized well by such contrasts. The terms are abstractions — concepts that lie just beyond the outer bounds of reality. But they can be useful, if used cautiously.

The professionals — conventional environmentalists and resourcists (Livingstone 1981) — who now dominate the field of environmental assessment and resource management are predominantly males of a technocratic demeanour. In the field of social assessment more women with strong consciences and feelings appear to be leaders than in environmental assessment.

Among the non-governmental activists in the Great Lakes, women are playing an increasingly leading role. Their concerns emphasize clean, healthy beaches and swimming waters, chemical contamination of humans and especially babies, animal rights, nature preservation, and healthy communities. These concerns are not being well served by the conventional experts of environmental assessment with the substantive concepts and procedural techniques that are now dominant. In effect, social assessment may have arisen in part as a kind of left-wing complement to environmental assessment.

In our work on cultural reform and sustainable redevelopment we start from the awareness that there are useful roles for harsh as well as for gentle concepts/methods. In effect, society uses harsh concepts/methods for people and groups who act harshly and gentle concepts/methods for those who act gently — see the hard shell and soft core respectively of Figure 3. Balanced information services should relate to both of these.

Closing Comment

With our "cultural reform and sustainable redevelopment" we are, in effect, trying to apply Aldo Leopold's land ethic, where land really means the man-nature ecosystem. Our view of our endeavours may resemble that of Leopold (1948) in "The Land Ethic" concerning his:

> *I have purposely presented the land ethic as a product of social evolution because nothing so important as an ethic is ever "written." Only the most superficial student of history supposes that Moses "wrote" the Decalogue; it evolved in the minds of a thinking community, and Moses wrote a tentative summary of it for a "seminar." I say tentative because evolution never stops.*

Most appropriately, his concluding observation remains as true todays as it was in 1948:

> *By and large, our present problem is one of attitudes and implements. We are remodelling* [our land] *with a steam shovel, and we are proud of our yardage. We shall hardly relinquish the shovel, which after all has many good points, but we are in need of gentler and more objective criteria for its successful use.*

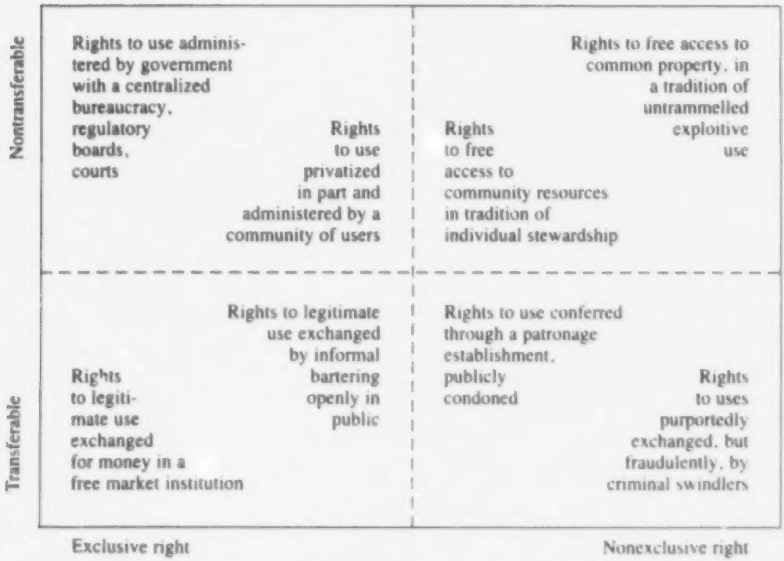
Nontransferable
Transferable
Rights to use administered by government with a centralized bureaucracy, regulatory boards, courts
Rights to use privatized in part and administered by a community of users
Rights to free access to common property, in a tradition of untrammelled exploitive use
Rights to free access to community resources in tradition of individual stewardship
Rights to legitimate use exchanged by informal bartering openly in public
Rights to legitimate use exchanged for money in a free market institution
Rights to use conferred through a patronage establishment, publicly condoned
Rights to uses purportedly exchanged, but fraudulently, by criminal swindlers
Exclusive right
Nonexclusive right

Figure 3. A perspective on ways in which rights to use of fish and similar "resources" are "managed" in our society.

Explanatory Note: In the four inside characterizations, the exclusivity and transferability of user rights are satisfied in a practical manner. User rights in these four inside types are less sharply defined than those in the four corners. The schema may be viewed to have a soft core with a more sharply defined hard shell or edge. Source: Based on Regier and Baskerville (1986), expanded from a schema by Dales (1975).

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The Role of Environmental Assessment in Support of Sustainable Development

R.D. Jakimchuk

Introduction

Notwithstanding the considerable progress made in developing an environmental assessment process in Canada over the past 20 years, there has been little progress in implementing sound environmental management practices. In this brief essay, some of the shortcomings of our current resource management practices and some fundamental obstacles to achieving sustainable development goals within current realities will be explored. The focus of the essay is on the role of environmental assessment in supporting sustainable development within the broader context of the sustainable development concept and resource management questions.

Whether a resource use is consumptive, such as forestry, or non-consumptive like bird watching, it places a demand on the environment that can range from minor and temporary interactions to major manipulation of water, land, or other environmental components. It may be useful then, to fashion a major premise of sustainable development: the only unlimited resource is sunlight and sunheat. All other planetary resources must be treated as finite entities that may change in form and structure according to physical laws but which must be recycled. This, and stabilization of the human population at some level, is necessary in order to achieve sustainable development, and to ensure the health of the planet and its inhabitants within existing evolutionary trends.

Before a role for environmental assessment in this process can be defined, it is necessary to examine some prerequisites for sustainable development:

- the provision of adequate and reliable technical information upon which decisions for development can be made without environmental impairment;
- the identification of examples of environmental protection that achieve economic benefits or efficiency, although it is expected

that case histories will be lacking for most current development activities or scenarios; and

- a new basis on which to evaluate environmental resources within our development and economic framework. In fact, the implementation of sustainable development requires the definition of entirely new economic criteria and systems.

Economic Prerequisites for Sustainable Development

The changes in economic valuation required for sustainable development on a global basis are so fundamental as to be revolutionary. They involve allocating sufficient value to clean air, water, and other resources so that their intrinsic worth is reflected in routine development activities. This will necessitate new concepts and definitions of economic efficiency, profitability, and success. One of the greatest obstacles to sustainable development is the undervaluation of temporarily abundant common property resources. This undervaluation leads to waste, depletion, and impairment of those resources over the long term. True value must reflect costs to long-term environmental productivity and future human needs. A man dying of thirst would place an incalculable value on access to water, a fundamental necessity of life. How much would clean air be worth in Mexico City in terms of its contribution to human health, longevity, and the alleviation of suffering?

Because of its current abundance in Canada, pure water is grossly undervalued. It sustains profitable economic development at the expense of future and alternate uses. This undervaluation contributes to the serious impairment of water quality in developed areas which, in the case of acid precipitation, may be transferred to uninhabited areas or across international boundaries.

The true costs of undervalued resources should be incorporated in our economic models. These models should include an assessment of future options foregone as a result of contamination, costs of future rehabilitation, and some social index that takes into account values to present and future human well-being. A new economic valuation system must alter present notions of supply and demand. Under current conditions, abundant supply usually reflects low unit value. However, using water as our analogy, we require a new measure that will consistently reflect the true "sustainable" value to humanity and ecosystems of the resource rather than its current competitive value as a once-cycled development commodity.

As yet, we have no mechanisms to achieve this new economic order. Both capitalist and communist political systems have failed to achieve a sustainable development mode while pursuing economic goals for their populations. Western economies, however, have achieved a consistently higher level of economic prosperity along with higher environmental standards. Some form of economic sanction analogous to tariffs may be necessary as an incentive to maintain a high level of environmental protection until such time as the true value of exploited resources is routinely recognized and reflected in the way they are used and managed.

The development of an alternative and widely supportable economic model is one of the major tasks for the environmental assessment process in support of sustainable development. A myriad of topics will comprise this task. It will be necessary to support studies and develop scenarios in conjunction with the best available economic and environmental expertise in order to establish viable options for resource valuation in a national context. In order to succeed internationally, similar principles will be required. The task of achieving an international sustainable development model and consensus is mind boggling and a topic beyond the scope of the present discussion. Without a global resolution of the central problem of economic valuation, however, no single country will be able to implement a true sustainable development policy without serious competitive disadvantage and economic dislocation.

In Canada, our present generally high level of environmental quality is less a tribute to enlightened environmental management than to our vast geographic area, low human population, and abundant resource base. At present, our vast tracts of "marginal" lands represent a buffer against environmental degradation in settled areas. At today's values, there is no economic incentive to develop vast areas of our hinterland except for hydro-electric potential or mines in specific areas. So these "marginal" lands keep on producing an abundance of clean water, fresh air, wildlife, and trees. Therein lies much of our environmental wealth and future options.

Environmental Assessment in Canada

As mentioned earlier, environmental assessment processes are well developed in Canada. In particular, the process of public consultation has been highly developed and refined, enabling a wide cross-section of citizen involvement in the assessment process. It is my thesis, however, that the conceptual and administrative mechanisms in place

for environmental assessment far exceed our ability to implement their policies and recommendations.

Our ability to do so is constrained by several factors including:

- lack of adequate technical information;
- inability to discriminate between real and spurious environmental issues; and
- lack of federal-provincial-municipal coordination in environmental planning.

The Technical Data Gap

The lack of technical information necessary to properly assess and adjudicate environmental conflicts is somewhat surprising considering the vast institutional apparatus for dealing with environmental matters in this country. At present, however, our assessment processes are limited by the availability or quality of technical information upon which to predict the nature and severity of impacts and their consequences to society. In the wildlife field, for example, there have been insufficient pre-development baseline, monitoring, and experimental studies to generate meaningful cause-effect relationships or correlations between development actions and ecological reactions. This is a result of the complexity of the technical issues and the high costs of carrying out scientifically adequate studies. We have made little progress in the last 20 years in dealing with this fundamental need for reliable information necessary for a variety of purposes ranging from land use planning to environmental assessment and sustainable development. In fact, in the process of increasing the scope of the assessment process to encompass public values (a quasi-political role), socio-economic impacts and cumulative impact issues, we have inadvertently built on a foundation of severely limited or unreliable knowledge.

It is, at best, boring and, at worst, shameful to see the same reviews and summaries of literature in a 1988 EIS as in a 1978 EIS. Reviews commonly cite earlier reviews rather than original sources and rely heavily on personal communications, anecdotal information, or a varying quality of unpublished literature to sustain their analyses. There is woefully little that is new to add to this tired information base. New information that does arise is often used without discrimination as to its reliability, validity, or scientific limitations.

There is inadequate commitment by governments and development proponents to fund good quality research. Further, standards of research and goals are often so ill defined that contradictory or equivocal findings are common. We have become so used to "making do" with inadequate information, that it is now an ingrained practice.

There is also a tremendous gap between the research activities and priorities of the academic community and those of the environmental assessment community. The cross-flow of information between the two is limited or fractious.

The Problem of Objectivity

A major shortcoming, somewhat related to the foregoing discussion, is the politicization of biological issues within the assessment process. This politicization has two forms. The first is biased use of scientific information to promote non-scientific values. An example is the deliberate or inadvertent exaggeration of adverse effects of a project on wildlife as a means to forestall incursions into wilderness areas when the real issue is aesthetic preference to maintain pristine wilderness rather than a risk to wildlife productivity. A similar manipulative use of the database can also be found in the promulgation of vested development interests.

The second example of negative politicization occurs when technical-level advisors are influenced by the political acceptability of policy options and structure their advice according to those perceptions rather than according to objective technical criteria. In this way the analytical requirements of the system break down, often to the peril of the politician who has been told what someone thought he wanted to hear rather than a potentially problematic analysis.

These tactics have contributed to confusion, uncritical acceptance of hearsay in environmental assessment processes, and imperfect decision-making. This has been one of the greatest deterrents to progress in defining real issues and focusing on how to resolve them.

Biologists in government service are particularly influential in putting forth their views. Although they may attempt or purport to be without bias, that bias does exist and is largely unchallengable by outsiders (consultants, public interest groups, and private citizens) because of the inherent power of the government spokesman in his access to policy-makers, the media, and the support of his colleagues in other agencies. This power can be used to reinforce certain interpretations and downplay contrary or dissenting viewpoints. Instead of fostering the benefits of rigorous debate and questioning,

the environmental management process often selects "team players" and fosters uncritical acceptance of conclusions, opinions, and concerns oriented toward a certain viewpoint.

An example of such misdirection concerns the potential impact of opening the Arctic National Wildlife Refuge in Alaska to oil exploration, on calving and post-calving areas of the Porcupine caribou herds. Canada presented a position paper on this issue to the U.S. Department of the Interior based on a technical paper that presented a number of unsubstantiated premises and conclusions (Canada 1987). The seriously biased technical paper formed the underpinning of a major Canadian government policy statement. No one expects policy makers to possess a sufficient technical background to evaluate such documents. The failure appears to be the politicization of an environmental issue at the technical level. How can we expect to progress to sustainable development if we cannot establish an objective basis for discriminating between real and imaginary environmental problems?

A voluminous body of information from long-term field studies is available that contradicts the major conclusion of the technical paper that the caribou herd would suffer a major decline and affect the subsistence opportunities of native people in Canada. A number of undocumented issues and "concerns" were given credence in the technical paper, and the majority of the extant database was ignored and uncited. The net result was to obfuscate the progress that has been made since the Berger Inquiry in 1975 in understanding development–ecological interactions in a real case history. In addition, such a document hinders the environmental assessment process and the opportunity to improve our understanding of the real consequences of interactions between development and environmental concerns. This example illustrates the conundrum that if all development is presupposed to be detrimental, none can be sustainable.

A Need for Self-Examination[1]

In Canada, our resource management record has had several prominent failures. Until we can identify and learn how these failures occurred, we will be unable to develop an appropriate approach in support of sustainable development. We should candidly examine how and why we have failed in questions of resource stewardship even if it is distasteful. The failures I refer to had the benefit of a large

[1] "Those who cannot remember the past are condemned to repeat it" — George Santayana.

government management infrastructure, legislative and regulatory authority, and funding for management research and enforcement.

The examples I refer to are:

- failures in management of the Pacific coast salmon resource, particularly Chinook salmon, to ensure sustainable yields for commercial and recreational use;

- failures in forest management in British Columbia involving inadequate reforestation, environmentally damaging forestry practices, and wasteful exploitation; and

- failures in management of certain species of migratory waterfowl, to ensure sustainable yields for Canadian consumptive and non-consumptive uses (Jakimchuk and Sopuck 1987). This failure involves a lack of assertion of Canadian interests in the resource leading to overharvests in the United States and subsequent population declines.

Although much attention is given to the problem of acid precipitation, particularly the role of the United States as an originator of the problem, these three examples represent major current issues in resource management and stewardship that fall within the jurisdiction of Canadian management agencies. The second example is within a provincial government jurisdiction; however, it is a case in which common property resource values have been progressively eroded despite the existence of a vast body of knowledge of how these can be managed and developed in a sustainable manner.

I contend that a critical study of our failures will provide insight into how mechanisms for environmental protection and sustainable development can fail, what remedial processes are necessary to deal with current shortcomings, and necessary strategies for the future. This should be a major goal of environmental assessment in support of sustainable development.

The Need for Inter-Governmental Coordination

Finally, there is a need for a greater link between actions of various levels of government to ensure the maintenance of environmental quality and values. This is a need not only for greater coordination on environmental issues but for a formal accord dealing with consistent approaches to environmental problems irrespective of jurisdiction or authority. Both regulatory and assessment mechanisms vary greatly

across the country and within individual provinces. There is no reason to have a double or triple standard to deal with a given environmental issue. It is of vital importance to develop meaningful environmental standards within, and agreeable to, all levels of government if we are to effectively pursue sustainable development policies and cumulative impact questions. There must be consensus and a mechanism to ensure that environmental issues receive appropriate treatment at all regulatory levels in Canada. This will, in part, rest on our success in discriminating between real and spurious issues so that efforts can be channeled into problem-solving.

At present, there are wide discretionary and political interpretations in resource management issues which, in pursuit of short-term economic goals, often contradict good management practices. Many important decision-making powers at provincial and municipal levels affect environmental values and our productive land base. In fact, many of the more severe and persistent environmental problems are closely associated with municipal and urban development and are not subject to the technical awareness, input, or scrutiny that is required to maintain environmental quality in concert with economic development.

There has been a tendency in Canada to focus on mega-project or frontier developments (northern pipelines, roads, etc.) as having major environmental implications while comparable actions in settled areas receive relatively little attention. It is ironic that many people who voice environmental concerns for development in distant areas fail to recognize the importance of habitat losses and environmental degradation associated with urban sprawl and development in their local area. This is a corollary to the notion "the grass is greener on the other side of the fence." In this case, the problems are always greater away from home.

In Canada we have some truly astounding paradoxes. For example, learned and heartfelt concerns about the effects on water quality of relatively innocuous linear developments in northern areas are counterpointed by the massive daily dumping of raw, untreated sewage by the city of Victoria into the beautiful and productive surrounding marine environment.

We must conduct adequate research to meet environmental management and planning needs and we must cease squandering time and money by "rediscovering the wheel" every time an environmental issue is raised or assessment process is undertaken. The ultimate goal of sustainable development is no more and no less than the enlightened application of precepts of sustained yield

resource management and integrated land use planning. Just as certain standards are ensured by a national housing code, in the interests of the safety and health of our citizens, we must strive towards a similarly acceptable basis for environmental management at all jurisdictional levels. This would be a signal step toward resolving the inconsistent assessments, politically expedient policies, and paradoxical practices briefly examined in the foregoing discussion. This initiative for a national consensus on standards should be a major goal of environmental assessment in support of sustainable development. It will require eventual negotiation of a national accord at the first ministers' level.

New Directions

The report of the National Task Force on Environment and Economy (NTFEE) (1987) was disappointing in its traditional approach to what has been termed an urgent need for a world system of sustainable development. While many of the recommendations are laudable and worthy of implementation, they fail to recognize the need to develop a revolutionary economic model that can be applied and accepted internationally, and to attack the deficiencies of our existing environmental management systems. The first step is to acknowledge our failures and learn from them by a deep and thoughtful analysis. Otherwise the NTFEE recommendations are mere statements of good intentions.

As mentioned previously, our environmental assessment processes and analytical concepts are ahead of our ability to implement their recommendations and our inadequate technical database is limiting our ability to act on many urgent environmental questions. In addition, there are jurisdictional and institutional problems impeding our ability to make real progress in this field. The foregoing discussion only touches upon the issues in most urgent need of attention if we are to make progress in developing mechanisms for sustainable development.

Both the World Commission and NTFEE reports emphasize the importance of political will to the success of sustainable development. Without question, such will is necessary; however, it is important to ensure that it rests upon a firm foundation. The current world economy is such that a unilateral attempt of a nation to unilaterally achieve sustainable development would be economic suicide; the concept cannot compete with current economic imperatives. Canada would quickly suffer economic hardships if the true economic cost of environmental sustenance were incorporated into our industrial and

economic strategy. The dollar cost of sustainable development in contemporary economic terms will be staggering. This is a major problem that is not addressed by documents such as the report of the National Task Force.

There is also a pressing need for a greater commitment of manpower and financial resources to address the questions raised above. Our present funding levels for meaningful environmental research are inadequate for the job to be done. The practice of EIS preparation is usually underfunded and done within an unrealistic time-frame. Monitoring and implementation of environmental recommendations are often far less rigorous in practice than promised by environmental statements and commitments. There is virtually no financial support for well-designed impact-oriented research with clear and achievable objectives. Questions pertaining to a means of achieving sustainable development will require major funding comparable to major United Nations or external aid programs. The application of this funding should be well directed and critically evaluated, and include input from a wide cross-section of Canadian society.

This essay is written from the perspective and bias of an ecologist. One of the evolutionary aspects of environmental assessment has been the broadening of the scope of assessment to encompass human values, social considerations, and quasi-political concerns. As mentioned previously, this broadening has greatly expanded and improved the consultative process; however, it has not contributed similarly towards improving the technical basis for environmental management. In the final analysis, the major environmental issues facing the world are ecological in nature. They involve life processes and the interrelationships among organisms in the biosphere. These are the environmental constraints that govern our present, and that will dictate our future well-being. And this is where we need to emphasize our approach to sustainable development. We need to learn how to protect, perpetuate, and value our environmental resources for the dual long-term goals of human development and life quality. The issues require far more than lofty intentions and stirring rhetoric. They require an honest and sober examination of how human society presently deals with its environmental resources and the means to achieve the transformation to sustainable development. Conventional terms of measuring these values are no longer adequate as a measure of our future prosperity. The consequences of the present path of global society and alternatives have been well articulated in the report of the World Commission on Environment and Development (1987).

This brief essay cannot explore all the points that require attention for progress toward sustainable development. The task is enormous, and the problems will surely outpace solutions for years to come. Many of the solutions require major restructuring of national goals and will rely on long-term education on an international scale in the values and imperatives of sustainable development.

Part of the answer within Canada lies in a concerted effort to acquire relevant ecological knowledge and to conduct better resource management within existing institutional frameworks. A viable private sector involvement in research and management evaluations would be a major asset to that effort. Those disciplines that are most professionally successful in our society (law, medicine, accounting) have in common that the majority of practitioners occupy the private sector. At present, the status of the private environmental sector in Canada probably reflects the lesser value accorded to environmental resources by Canadian society.

Environmental consulting practitioners often lead a marginal existence and are poorly utilized. Well-trained ecologists are begging for jobs; some consult as "basement" operations, rely on minor jobs and fiercely compete to maintain themselves. Instead of fostering the development of a strong and viable private sector, contractors, including governments, abet this scenario by maintaining a lowest-bidder policy. This situation occurs at a time when there is a need to utilize all available talent to deal with the environmental questions posed by existing and sustainable development issues. If we cannot accommodate a viable and private professional sector in the environmental field, we cannot hope to extend the sustainable development philosophy to other sectors of society.

We must also seek out and encourage critical debate and dissenting opinions in the environmental field. Progress can only be made by using the diverse opinions and experiences available to stimulate change and new approaches. Our problems are not based on a lack of institutional capabilities but on how to direct these capabilities into more positive and productive avenues.

The sustainable development concept is of vital importance, but at this stage it is the focus primarily of good intentions, pollyanna rhetoric, and fickle political enthusiasm. Whether we can go beyond this initial level of interest and make step-by-step progress will depend on a level of commitment of funds and societal resources that is presently unappreciated by governments or industry and unprecedented in the environmental field. The commitment to making and

implementing hard decisions based on a critical analysis of existing deficiencies in environmental management will be an important first step.

I have explored very briefly the genesis of some contemporary problems and how they relate to needs for environmental assessment in support of sustainable development. It is important to recognize that the problems do not arise from an inadequate assessment process but from the basis upon which assessments are made. The most important needs are to comprehensively assess the reality of the economic implications of sustainable development and decide how we can properly execute our existing environmental responsibilities within established jurisdictional frameworks.

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Environmental Assessment and Sustainable Development: Exploring the Relationship

Susan Holtz

Introduction

This essay concerns the relationship of the process of environmental impact assessment (EIA) to the relatively new concept of "sustainable development." Both environmental impact assessment and sustainable development date, as new ideas, from the 1970s, and both have undergone a significant evolution since that time. Environmental impact assessment in Canada has developed as a scientific and political process involving many different and often conflicting interests. Its development has been incremental, as participants in the process, and those responsible for it, have made criticisms and suggestions from their own experience. At present, the federal Environmental Assessment and Review Process (EARP) is undergoing an extensive review, and as a result, may be established by legislation as a regular procedure applying to all federal undertakings. At this time, March 1988, EARP is set up under an Order-in-Council; compliance with it cannot easily be enforced, if it can be enforced at all. At the provincial level, environmental assessment processes vary widely; the most recent legislation establishing the procedure was introduced into the Nova Scotia Legislative Assembly in March 1988. Other provinces, such as Quebec and Ontario, have had EIA legislation for several years.

Sustainable development, by contrast, is not something as concrete as a procedure for reviewing development project proposals. It is a concept that functions as both a goal in the world of actual decisions and as an evolving idea. In the latter context, it is an ideal that may never be reached but which is still the lodestar of a new vision of human society. Whether it will, in fact, inform decisions in such a way as to effect significant transformation of Canadian society depends, partly at least, on how the idea is reflected in formalized public decision-making, such as in EIAs, public spending, and public policy.

I will approach the topic of environmental assessment and sustainable development by first examining in more detail the concept of sustainable development, especially as a touchstone or goal for Canadian society. Second, I will look more closely at the existing and

possible role of EIA as a process in which sustainable development can be pursued. Finally, the limitations of EIA in furthering sustainable development will be considered.

Sustainable Development as a Concept

The phrase "sustainable development" was coined in the 1970s as a response to the newly perceived need to "make space" in the concept of economic development for conservation and protection of the biophysical environment. At the time, however, this reflected a need to somehow add environmental considerations onto, rather than integrate them into, economic planning. It was unclear where the starting point for analysis was, although from an environmental viewpoint, the primacy of protecting the integrity of the biophysical environment was uncontested.

The World Conservation Strategy Environmental Objectives

In 1980, the publication of the World Conservation Strategy (WCS), developed by the International Union for the Conservation of Nature and Natural Resources (IUCN) and the World Wildlife Fund, provided a short but comprehensive set of environmental objectives that societies would have to meet to ensure continued global habitability. The underlying perception was that the human species is now so numerous and technologically so powerful that we may well cause irreversible harm to the biosphere, and on a wide enough scale to jeopardize the future of human societies. The three WCS objectives are:

- maintenance of essential ecological processes and life-support systems;
- preservation of genetic diversity; and
- sustainable utilization of species and ecosystems.

These objectives are intended as the basic checklist for human societies and their various activities, which all depend on the earth's biosphere. They are not, however, identical in what they imply for human societies or for appropriate attitudes toward the rest of the biosphere. In particular, there is a potential for divergence of values between the second and third objectives.

The second objective, the preservation of genetic diversity, *can* be interpreted as an instrumental value. Genetic diversity should be preserved because it is, or may be, of potential use of humans. The

reasons why genetic diversity may be of use to our species are several, including as a source for new products and cultivars, for aesthetic reasons, and for the possibly-yet-to-be-identified role that different species play in maintaining ecological processes. However, this objective can also be taken as a moral imperative to preserve all other species, or at least not to cause their extinction, because they have a right to exist. In this latter interpretation, preservation of genetic diversity is a fundamental, rather than an instrumental value. It implies a place for other species in the world as co-equals with humans. Humans, from this perspective, may or may not have an ethically defensible role as users or controllers in the biosphere.

On the other hand, the third objective, sustainable use, is clearly a human-centered, instrumental value. Use of other living creatures and species is acceptable, so long as we do not impair future use by humans. It is possible to subsume this objective in the second goal, genetic diversity, as a requirement not to overharvest or hunt existing species to threatened levels or to extinction. Such a requirement can be seen as a reflection of the rights of species to exist, as just discussed. However, this is not really consistent with the phrasing of the objective, with its focus on controlling human use so that humans can continue this use in the future, rather than for the sake of the intrinsic rights of species or individual organisms. I will return to this discussion later in this article. For now, let us note the tension between these two objectives, without, however, demanding resolution at this stage.

The Broadening Definition of "Environment"

The 1980 World Conservation Strategy principles provide a comprehensive framework for thinking about the biophysical basis for sustainability. Both before and since 1980, however, a parallel evolution in the notion of "the environment" has been occurring.

In the 1960s and 70s, the term "environment" was used without much thought for its implications. It meant, quite simply, the biophysical surroundings, excluding human beings and their constructed habitat. This definition reflected 2000 years of Western religious and cultural assumptions about the role of humans in the world. Human life was seen as fundamentally apart from, superior to, and in charge of the rest of the biosphere. There were additional refinements to this world view — for that is what it is — reflecting a hierarchy of rank that placed men above women, women above children, mammals above reptiles, and so forth. European coloniza-

tion added racism to this ranking, putting Europeans above other races.

The term "environment," then, at first quite unselfconsciously embodied this world view of a human species set apart from its living habitat; the concept of "nature" involves a similar perspective, though it carries a more romantic or emotional connotation. In the 1980s, this world view began to crumble. Increasingly, the perceived gulf between ourselves and everything else is disappearing. We see ourselves inside and a part of the biosphere, not apart from it. This view, though new in Western culture, reflects the perspectives of many other societies, such as the indigenous peoples of North America.

This change has been reflected in the changing dimensions of the definition of environment, particularly formal definitions, such as that used in discussions on the reform of EARP (see, for example, FEARO 1988). Not only do we no longer see ourselves as set apart, but many explicitly want cultural, social, and sometimes economic concerns to be encompassed in discussions about the environment. For instance, the caucus of environmental groups (CEN 1988) participating in the recent federal EARP review stated in their position paper that "'Environment' must be defined broadly to include biophysical, socio-economic, spiritual and cultural elements and interactions."

Similarly, the Canadian Environmental Advisory Council (1988) in its submission included in its definition biophysical components and "... aspects of the human economic, social, cultural and health environments which interact directly and indirectly with the biophysical environment."

"Conservation with Equity": the Merging of Environmental and Economic Goals

While the word "environment" was becoming inclusive of humans and their societies, another conceptual development was also taking place. This further step was the real integration of the biophysical criteria for sustainability (now quite well spelled out in the WCS objectives) with other human needs and values in the discussion of "sustainable development." Two globally significant events helped to articulate and spread emerging ideas. These were, first, the Ottawa 1986 Conference on Conservation and Development: Implementing the Word Conservation Strategy the proceedings of which are entitled *Conservation with Equity: Strategies for Sustainable*

Development (Jacobs and Munro 1987); and, second, the enormously important hearings and report *Our Common Future* (WCED 1987) of the United Nations-appointed World Commission on Environment and Development (WCED), chaired by Norwegian Prime Minister Gro Harlem Brundtland. Both these events involved representation from developing and developed countries, whose economies have elements ranging from traditional to centrally planned to market-oriented. Although all peoples, especially the poor, were not equally represented in the discussion, there was nevertheless a fair sample of the various forms that government and national economies take in the world today.

In these discussions, ongoing crises in both the ecological basis for survival and in the social and economic order were recognized as the initiating factors that demand change in the world and in our ideas about it. But there has been a forced conjoining of these two starting points of analysis into what we might call a unified theory of sustainable development, because, by the mid-1980s, it has become clear that these things are related in the physical world. Poverty and injustice are causes of stress to ecosystems, and impoverished environments undercut health and economic and social development. The world is truly a closed circle, and deep-seated problems in one area interlock with everything else in the human environment.

This realization underlies the emerging definitions of sustainable development. *Our Common Future* discusses the concept in some detail, and it is tempting to excerpt from it at length. However, two short quotes will suffice to convey its basic thrust (WCED 1987:46,40):

> *In essence, sustainable development is a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations.*
>
> *Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future...But* [sustainable development means] *that growing economies remain firmly attached to their ecological roots and* [that] *these roots are protected and nurtured so that they may support growth over the long term. Environmental protection is thus inherent in the concept of sustainable development, as*

is a focus on the sources of environmental problems rather than the symptoms.

Sustainable Development as a Functional Objective

The Brundtland Approach

For all the rapid conceptual elaboration of sustainable development, how to make the ideas actually change and inform decisions is, of course, the most important issue. And here, too, there has been progress.

The WCED report identifies critical institutional elements and objectives for their function to support in sustainable development. They are as follows (WCED 1987: 65):

- a political system that secures effective citizen participation;
- an economic system that is able to generate surpluses and technical knowledge on a self-reliant and sustained basis;
- a social system that provides for solutions for the tensions arising from disharmonious development;
- a production system that respects the obligation to preserve the ecological base for development;
- a technological system that can search continuously for new solutions;
- an international system that fosters sustainable patterns of trade and finance; and
- an administrative system that is flexible and has the capacity for self-correction.

The strength of this analysis is its emphasis on institutional development in many areas; its weakness is that it is difficult to imagine what criteria could be used to determine whether institutions are actually performing to these standards. Take the production system, for instance: what exactly does this statement imply? Does it mean, for example, that no individual factory shall reduce the biological productivity of its surroundings? No more discharges into streams unless the water can support the same fish and other plants and animals that it did before? Or does it mean that only a portion of

each country's ecological base will retain its biological productivity, its original ecological character? If so, how much of this base will be preserved?

Or, similarly, how can we tell if the technological system is searching effectively enough for new solutions? Do all societies need a similar level of effort or could this vary from country to country? Clearly, although this list gives a good overview, it does not provide operational criteria.

Moreover, this analysis begs the question of selective limits to growth, or, more accurately, limits to the quantity and rate of material throughput. While no humane observer can doubt that economic growth is needed to remedy the desperate poverty that afflicts most of the world's people, there is also no question that growth without limit runs up against ecological barriers and conflicts with other human needs and aspirations, such as a desire to preserve wilderness.

Thus, the conclusion we must reach about the WCED objectives is that, in operational detail, we are dealing with matters of judgement and opinion, not a clearcut check list. This necessarily moves the question of operational criteria into the world of political decisions.

Canada's Response to the Brundtland Challenge: Further into the Political World of Negotiation

This was also the implicit conclusion of Canada's National Task Force on Environment and Economy, which was charged with responding to both the Brundtland Commission and the Ottawa Conference on the World Conservation Strategy. The Task Force (1987), with members from government, industry, academic, and environmental sectors, produced some 40 recommendations. While advocating more effort in education, research, methodological tools, and demonstration projects, the majority of recommendations focused on the need for more widespread participation in, and responsibility and accountability for, integrating environmental concerns with economic decision-making. In its recommendations for multi-sectoral round tables and for the development of provincial and national conservation strategies, the underlying assumption of the report is that the variety of perspectives found even among people consciously committed to sustainable development requires that an ongoing process of debate and negotiation be the central feature of an implementation plan for sustainable development.

This is an interesting and little-remarked aspect of the Task Force's recommendations. It indicates that we no longer think of environmental problems as essentially scientific or technical. Rather, scientific information is seen as essential input into decisions, but it cannot automatically determine those decisions. Of course, in the real world, this has always been the case. Scientific information has rarely been complete and definitive; there are always other studies and unknowns. Also, economic and social realities have been more significant factors in decision-making. However, in the Task Force recommendations, the need to negotiate is made explicit.

The tension I commented on earlier between the environmental objectives of the World Conservation Strategy is not resolved by this approach. Nor are other tensions. For example, in a situation in which there is uncertainty about environmental effects, there will necessarily be some conflict between safety and concern about unwarranted economic dislocation. The moral ascendency of environmentalists or, for that matter, of those wishing to safeguard jobs, tends to dissolve in this new context. Parties, no longer under an unassailable banner of virtue, must work out together each course of action. Responsibility both for environmental protection and economic decisions becomes a little more diffuse.

There are extremely positive aspects to this situation. But to produce solutions, there must be an effective equality of power among participants, for negotiation only works as a positive process if the participants are equals. The real issue for the implementation of sustainable development is the quality of the various processes of negotiation that are set up. Do they involve all persons with a stake in the issue? Do they work to correct any inequality of resources and power among the participants? Is the process fair? Does the process draw out all the relevant information that is known? Can it identify critical unknowns? Will important new information automatically trigger a re-evaluation of decisions? Does the process itself promote defensive posturing or real interchange? These are the kind of issues that will determine whether we are in fact implementing sustainable development in EIA and other processes.

Environmental Impact Assessment and its Role in Sustainable Development

Widening the Scope to Include Conceptual Proposals

In Canada, EIA is widely considered to be an essential tool for sustainable development (Task Force 1987; CEAC 1988; and many other commentators). As I noted in the Introduction to this paper, its

practice has changed and developed in its 15-year history, and, at the federal level, is undergoing an extensive reassessment. Much of this recent discussion is focused on detail, which is not to say that it is unimportant. In my opinion, however, the most interesting proposal for EIA in the context of sustainable development is to bring conceptual proposals such as government policies and programs under the scrutiny of EIA.

At first glance this is a startling suggestion. However, both the WCED and the National Task Force on Environment and Economy strongly emphasized the need to make all government departments and decisions take ecological sustainability into explicit account, and to develop mechanisms for accountability for doing this. There seems to me to be no good reason why EIA processes which exist already, and perhaps EARP in particular, should not be expanded and, where necessary, modified to perform this function. This does not, of course, mean that all proposed government policy would be subject to public hearings. What it might mean is that all policy and program proposals would include a brief assessment of their environmental effects. In the relatively few cases where these effects were significant or controversial, a more complete environmental impact statement would be required, and possibly a public review. One of the political benefits would be the development of a procedure for dealing with environmentally contentious policy issues such as, for example, nuclear energy, water exports, or a proposed seal cull. Such a procedure would offer a routine way of resolving the issue. At present, one problem is the need in each case to invent a forum, which in itself becomes part of the political controversy.

The Gap in the Planning Context

In the recent review of EARP, one of the most significant deficiencies identified was the lack of a planning context in which assessment of specific projects and cumulative impacts could take place (CEN 1988). And although this was noted specifically in the review of the federal EARP, it applies equally to provincial EIA processes.

Two kinds of problems in EIA procedures occur quite frequently. One is that the project under review is regarded by intervenors as an environmentally unsound or unsustainable policy. For example, new nuclear generating stations. The fundamental issue is really the acceptability of the nuclear option and its various facets, such as long-term radioactive waste disposal plans. Such issues are clearly inadequately dealt with in a project-specific review, and hence the interest in policy reviews.

Another kind or problem arises, however, when there is no environmental policy context at all for a project evaluation — and, in fact, this is almost universally the case. I refer to this as the planning-context gap. Take, for example, a fairly ordinary EIA situation at the provincial level, a public review of a proposed gold mine. Nobody opposes gold mining *per se*, so the proposed activity itself does not involve a policy issue. But concerns may be raised about the transport and disposal of toxic chemicals used in the milling process; about destruction of wetlands from an access road; and about groundwater contamination from leached heavy metals. Against what objectives are these concerns to be evaluated? Typically there are no comprehensive, *negotiated* goals or standards for implementing World Conservation Strategy objectives and other environmental criteria at the jurisdictional level in which they must be applied, which is primarily the provincial level. Most resource and land use decisions, which are also the focus of most EIA processes now, are constitutionally a clear provincial responsibility (except in the North.) There are certain water quality and other national guidelines for some pollutants, there is no context for making decisions about wetland habitat protection or for protecting renewable resources. Above all, there is no land use plan in place that sets out comprehensive environmental objectives and translates them into the necessary restrictions on land use and development as the means through which they are made operational. However, planning along these lines is taking place now in the Northwest Territories.

Site planning and design are routinely done by environmental planners and landscape architects using overlay maps to pinpoint environmental sensitivity and to identify where different uses and facilities should not, and also could, be sited. In principle, a similar approach could be used at the provincial level — perhaps integrated with a federal plan — as the basis for provincial Environmental Planning Acts. In any case, work is needed to provide a framework for environmental decision-making if EIA processes are to function as they were originally intended, namely to review and mitigate environmental effects of proposed projects before, and not after, the damage is done. Without such a framework, decisions are not grounded in any firm environmental objectives. Thus, it is not surprising that the track record of the EIA process has been one in which very few projects have been rejected on environmental grounds. Against what criteria could they have failed to pass muster?

A planning framework, of course, should not increase the number of rejected projects in the EIA process, but should, on the contrary, set out environmental criteria and environmentally-based land use

restrictions so clearly that many conflicts never occur. In my view, it is only with the addition of some such planning process or act that EIAs will be able to make the contribution to sustainable development that they should.

Two Limitations on the EIA Process as a Tool for Sustainable Development

Finally, I would like to mention briefly two areas of limitation for the EIA process as a tool for sustainable development.

The first is simply that environmental assessment is basically a process of analysis and criticism rather than a creative process. It does not generate solutions; it sets limitations or requirements on what can be done. Real solutions come from a different mental process. In this sense, EIA processes define the rules, in the same way that traditional forms shape what a poet must do to write a sonnet. The rules do not generate the emotions, the thought, and the words, although they do limit the poet to 14 lines of iambic pentameter. Similarly, the ability to synthesize, to envision, and to design are not particularly fostered by assessment procedures. It is hard to imagine how they could be; but at least EIA processes should be monitored to make sure that they do not penalize creative solutions.

The second limitation arises from the as yet unresolved issue of trade in the context of sustainable development. The uneasiness of this conjunction goes back to the very focus of sustainable development. As discussed earlier, the touchstone often used is present and future human needs and aspirations. While an understanding of anthropogenic environmental stress and its relation to sustainability has been developing in the last decade, it is not obvious to me that there is an equally developed understanding of sustainable economic patterns. Much writing on this topic specifically tries to look at economic theory and practice as they relate to human needs (for example Ekins 1986). Increased regional self-reliance is often mentioned as a positive economic goal, partly as a way of improving the trade balance for poor regions and partly for second- and third-order environmental benefits such as reducing resources needed for transportation. At the same time, increased and fairer international trade is often described as essential for improving the situation of debtor nations. Without attempting an analysis of these arguments, it is nonetheless clear that there is no real consensus about the general and the specific role of trade in sustainable development.

This becomes a problem in EIA processes that are considering facilities and projects designed for export. While there has been increasing pressure over time to consider alternatives to the project, or need for the project (FEARO 1988), this becomes particularly difficult when dealing with exports. Moreover, one approach to sectoral planning in the resource sector has been to try to minimize environmental effects through reduction of demand for that resource. This has, in fact, been the basis for extensive work worldwide in developing sustainable energy policies. A project for export is immediately outside that policy context.

I have no solutions to this difficulty, but it does point to the need for additional thought about the role of trade and the role of economic self-reliance in sustainable development.

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Environmental Assessment in Support of Sustainable Development

Jeffrey A. McNeely

Introduction

Environmental assessment (EA) has usually been used primarily as a means of minimizing the negative biophysical impacts of projects and activities. The Asian Development Bank (ADB 1987) points out that its projects are "designed to include environmental components or regulatory safeguards to ensure that environmental damage — generally defined as damage to local natural resources — [is] avoided or minimized." To ensure representation of the environmental dimension in its projects, the ADB Operations Manual requires a statement on the significant impacts of each project and the detailing of measures adopted to reduce adverse impacts.

As a result of this essentially negative approach, EA has often been seen as an obstacle to development, as a gesture to environmentalists, or as a necessary hurdle to be overcome in the development process. "Sweetheart assessments" commissioned by the project advocates have often been considered adequate, particularly when undertaken after the essentials of the project had been agreed on by those funding the project.

This emphasis on controlling damage is not totally misplaced. As the Word Commission on Environment and Development (WCED 1987) stated:

> *Economic growth always brings risk of environmental damage, as it puts increased pressure on environmental resources. But policy makers guided by the concept of sustainable development will necessarily work to assure that growing economies remain firmly attached to their ecological roots and that these roots are protected and nurtured so that they may support growth over the long term. Environmental protection is thus inherent in the concept of sustainable development.*

But even the WCED took a traditional approach to EA, establishing "anticipate and prevent" as one of its major principles and focusing

on "the sources of environmental problems rather than the symptoms." While this is a useful advance on symptomatic relief, it is not nearly enough to ensure sustainable development. As I shall suggest in this paper, development planners can take a far more positive position than this and use EA to show how the productivity of natural resources can be enhanced in the development process; instead of "anticipating and preventing" damage, this approach advocates *enhancing nature's contribution to human welfare.*

Major Principles of Sustainable Development

The International Union for the Conservation of Nature and Natural Resources (IUCN 1988), in suggesting how its members could implement the WCED report, identified three main principles to guide activities aimed at sustainable development:

- *Going beyond the sectoral approach.* The world is governed by sectoral approaches, and those who are responsible for the environment are usually administratively insulated from those who manage development. But experience has taught that resources are not bound by sectors; judgements on resource use that may be technically sound within one sector can be disastrous beyond the boundaries of that sector. A new approach is required to build linkages between the sectors.

- *Building more effective international cooperation.* Nations are linked together in a complex web of investments, materials, communications, travel, and trade. Even internal policies of a nation can have profound impacts on the environment of its neighbours or even the world, so greater international cooperation is essential for solving the various interconnected problems facing the world community.

- *Building self-reliance.* Conservation is part of development, and should be integrated at the community level. Humans are not "resources," for whom productivity is the objective of life; rather, the objective must be quality of life, which involves health, security, literacy, longevity, harmony in interpersonal relationships, strength of family ties, and a whole host of other factors. Thus choices made about paths of development need to fully involve those who are directly affected. Local responsibility for local resources can help ensure adaptability to change, and promote community involvement in addressing questions of resource management.

Based on these three principles, the IUCN considers sustainable development to be a process that enables harmonious human relationships with natural resources to endure over time, and to adapt to changing conditions. Such development optimizes the capacity of the environment to meet the needs of people as defined by them, generating more security at the highest attainable living standard for an indefinite period. It requires that development be ecologically sustainable over the long term, consistent with social values and institutions, and based on local participation in the development process.

Sustainable development should provide lasting and secure livelihoods that minimize resource depletion and environmental degradation, without causing cultural disruption and social instability. It is an interaction among the biological and resource systems, the economic system, and the social system. It seeks to maximize the achievement of goals across all these systems through a dynamic and adaptive process of negotiation involving both users and producers. It involves the satisfaction of basic human needs for food, clean water, fuel, shelter, health, and education; freedom from unwanted dependence at both national and individual levels; and maintenance of the biological systems that provide the basis of all life.

Although the relative contribution of each will vary from place to place and time to time, sustainable development will always include five interrelated components:

- an economic dimension dealing with the creation of wealth and improved conditions of material life;
- a social component measured as well-being in nutrition, health, education, and housing;
- a political dimension pointing to such values as human rights, political freedom, security, participation, and some form of self-determination;
- a cultural dimension in recognition of the fact that cultures confer identity and self-worth to people; and
- an ecological component that recognizes the primacy of conserving the life-giving natural resources and processes on which all progress depends.

Development projects have always tended to stress the first two conditions; EA has tended to address only the last one. It is apparent

that EA, if it is to contribute most effectively to sustainable development, needs to consider as well the political and cultural dimensions.

This paper will suggest how EA can be used to help achieve sustainable development, as applied to water resources development projects in Sri Lanka and the Mekong Basin (McNeely 1988). While the cases deal with a specific sort of project, the conclusions of this paper are applicable in a variety of situations, both in developed and developing countries.

The Case of the Mekong Basin

One of the world's most ambitious development programs was designed in the early 1960s to develop the water resources of the Mekong River. Involving the governments of Laos, Cambodia, South Vietnam, and Thailand and virtually all major international development agencies, the effort was projected to last some 30 years and involve constructing dams, reservoirs, and irrigation canals throughout the region. The population of the Mekong Basin was increasing at an annual rate of about 2.5%, so increased productivity was required to feed the additional mouths; expansion of total land under crops in the basin had reached its productive limits, and modernization of basin agriculture would depend on more intensive use of the suitable agricultural soils. Further, the natural resources of the basin were already being heavily over-exploited, leading to the destruction of potentially renewable resources such as soil, forests, and wildlife. Clearly, this over-exploitation could be controlled only if viable alternatives for earning a living were available to basin residents.

The challenge in the Mekong was to develop the water resources in a way that enhanced the natural systems upon which sustainable forms of development could be built. Environmental impact assessments carried out by ecologists pointed out that inundation *per se* was likely to have little direct effect on regional wildlife species because the inundation areas for most of the proposed dams were relatively small and were already under some form of agriculture.

The approach recommended was to rationalize land use in conjunction with the construction of major dams. The most productive lowlands would be used more intensively through irrigation, thereby reducing agricultural pressure on the more marginal land of the hills. The uplands were being cleared of forest for short-term forms of agriculture, so better use of the lowlands would enable the hills to revert to their most productive long-term uses: forestry, watershed

protection, recreation, and wildlife conservation. In addition, the dams would produce large blocks of marketable energy, sufficient to meet the needs of the region for decades. This would be used to replace consumption of both firewood and fossil fuels, at least some applications, and permit basic changes in land-use patterns.

The protected area system, designed to protect the watersheds, would play an important role in the overall land-use plan for the basin, in which water resources development is the central feature. Economic, social, political, cultural, and ecological aspects could be combined, as they were considered part of the overall development package long before detailed projects were designed for any of the mainstream dams.

The Case of the Mahaweli Scheme in Sri Lanka

The Mahaweli River Development Scheme involves harnessing Sri Lanka's largest river to irrigate its lower basin as well as the valleys of several other rivers. More than 2 billion dollars (U.S.) of external funding is being provided to Sri Lanka to bring 117,000 hectares of land under permanent irrigation and to resettle about 500,000 people on new farms. By building four new dams in the upper catchments of the Mahaweli River, Sri Lanka's total electric generating capacity would be more than doubled.

Such a massive development scheme is certain to have major environmental impacts, so the U.S. Agency for International Development (USAID) funded an environmental assessment of the Mahaweli Project in 1979-80. Ecologists on the team pointed out that the Mahaweli Basin is a biologically rich region, with 90 known endemic plants and animals and many large mammals, including some 800 elephants. The development of the basin for agriculture threatened to reduce these prime natural habitats, displacing the large mammals and causing increased human/animal conflicts. Further, if spontaneous settlement led to destruction of forests on land not suitable for intensive agriculture, resulting disturbance of the hydrological regimes could lead to a shortened life for the irrigation networks due to sedimentation and flooding.

In response to these ecological arguments, the Government of Sri Lanka placed a high priority on the upgrading and establishment of four protected areas in prime wildlife habitats and the protection of the catchments of reservoirs. This system of protected areas was to be interlinked by forest reserves and "jungle corridors" to promote maximum ecological and genetic resilience in the system and to

protect elephant migration routes. In addition, each unit would be surrounded by a 1.6 kilometre buffer zone where field crops would be prohibited as a measure to reduce conflicts between wildlife and neighbouring communities.

This progressive program of integrated land use involving a range of different types of protected areas in support of sustainable development is based on the realization of the benefits that nature conservation in some 135,000 hectares can bring to people on the land being improved for agriculture. If these benefits were to be realized, appropriate objectives for the protected area management project were required. The following were suggested (McNeely 1982):

- to manage all protected areas in such a way as to maximize benefits to water development; to manage upstream areas for watershed protection, riverine areas for bank stabilization and flood mitigation, and floodplain areas for enhancement of water quality, all of which are aimed at controlling sedimentation rates and lengthening the life of the project dams, reservoirs, and irrigation networks;

- to contribute to the integrated development of the land resources of the Mahaweli Basin, giving particular attention to the conservation of outstanding natural areas as national parks and reserves and utilization of marginal lands as buffer zones and managed forests;

- to provide stable rural employment opportunities, through use of local people as staff for protected areas, casual labour for maintaining roads and tracks, and entrepreneurs and personnel for private enterprise tourism;

- to provide opportunities for healthy and constructive outdoor recreation for local residents and foreign tourists in carefully selected portions of the protected area system, which are based upon the outstanding natural and cultural characteristics of Sri Lanka;

- to maintain a sufficiently large area of land under protective management to conserve natural ecological processes and to ensure that open options are retained to adjust to changing demands, new technologies, and emerging conservation practices;

- to maintain a network of protected areas in the Mahaweli Basin to ensure the continuity of evolutionary processes, including

animal migration, particularly of elephants, a species of special historical, economic, and ceremonial value to Sri Lanka, maintenance of genetic diversity, and complexity of natural ecosystems; and

- to provide facilities and opportunities in natural areas for purposes of formal and informal education, research, and monitoring of the environment, and to link these activities explicitly with the management of the protected area network.

Conclusions

This paper has shown that EA can play a crucial role in promoting linkages between sectors, and in integrating environmental considerations into sectoral programs and projects. Properly executed, EA can analyze the interactions among economic development, social and cultural factors, and environmental resources. Then, based on such analysis, environmental management options can be developed.

This paper has been too short to develop fully the thesis that EA needs to be far more proactive than reactive if it is to contribute significantly to sustainable development. However, based on the cases presented above, plus the principles advanced earlier in the paper, I suggest that the following major points are worthy of further consideration.

EA tends to look at only a narrow spectrum of the issues that need assessing. Environmental factors, such as impacts on species, ecosystems, productivity and water quality, pollution, have tended to be the main issues assessed by EA, which of course is entirely consistent with the label. But assessments of projects in terms of their contribution to sustainable development require a far wider range of investigations. These need to include: socio-economic assessments, particularly in terms of benefits to local people and the contributions of biological diversity to human welfare; "ethical impact assessments," which take into consideration far larger questions about the values of the society being developed; cultural assessments, which examine issues of how the proposed projects will affect the local culture; and several others.

EA is almost invariably carried out too late, and ends too soon. EA should be done not *after* the project has been designed, as is usually the case, but rather at the very earliest stage, when a series of alternative projects are being considered. In addition, EA needs to continue long after the project has been "assessed." Institutional mechanisms should be established for monitoring both environmental

and socio-economic aspects of projects during their implementation phase, and to enforce necessary modifications to projects when they are diverging from the planned course.

EA needs to look at objectives as well as impacts. In order for EA to play its most useful role, it should be involved when objectives of development are being decided. Rather than being confined to project interventions, it should deal with the major value decisions on the objectives of development, which are addressed before choices are made between possible projects.

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The Relationship of Sustainable Development and Environmental Assessment, Planning, and Management

Brian D. Clark

Introduction

The discussion paper by Julia Gardner is both stimulating and frustrating. Stimulating because for the first time a serious attempt is made to look at the fundamental issues relating to the links between sustainable development, environmental evaluation, and resource management; frustrating because while it stimulates it also irritates! This will be elaborated in the discussion that follows. Initially, certain general and specific comments will be made on both the substance and direction of the paper. This will be followed by certain suggestions as to how the concept might be developed and the indication of possible areas where future work could usefully be developed.

Initial Reactions

Given the complexity of the various themes included in the scope of the study — sustainable development, environmental assessment, planning, and management — the author does not develop and clearly express the very complex concepts contained within it in a fully understandable manner. As a result, it is expressed in a kind of intellectual shorthand, parts of which can be understood by aficionados of some of the concepts but which *in toto* leaves many ideas hanging in the air.

Specifically two points can be made:

(a) Gardner assumes that there is now a general and universally accepted definition of sustainable development. This can be seriously questioned in the light of work by authors such as Barbier (1987), who would argue that the concept, and its applicability, are open to many interpretations. In particular, can the concept of sustainable development apply to manufacturing activities and urban resource allocation issues as well as to more generally accepted themes such as agriculture, forestry, and integrated rural development?

(b) Gardner uses the terms environmental assessment (and environmental impact assessment at times), and planning and management without clear definition. This leads to some problems. For

example, Gardner states that environmental assessment "is a planning tool." This is clearly one definition. However, there are many who would argue, this writer included, that environmental assessment is increasingly seen as a process rather than an explicit "tool" and is as much related to sound corporate management as to an input to decision-making.

The attempt to formulate and link both process-oriented principles and substantive principles is critical and central to Gardner's thesis. It is my contention that these principles should be spelt out in more detail. Gardner's discussion could be strengthened by expanding on the underlying principles. A justification should also be given as to why this particular structure was adopted. This point is raised because other analytical frameworks of decision-making exist, such as policy formulation and implementation models, which might be equally relevant to the linkage of sustainable development and environmental assessment.

The nine frameworks for review present a wide-ranging and varied list. It would be interesting to know why these specific frameworks were selected and others rejected. If the criterion was, as stated, "that they appear to be seeking to support a more adaptive or integrated approach to decision-making" it could be argued that models such as "integrated rural development," currently being implemented by the European Economic Community (EEC) in a number of member states, would certainly be worthy of consideration.

The nine frameworks appear to be heavily biased in favour of conceptual and theoretical approaches. While it is entirely legitimate for the author to adopt such an approach, there is the potential danger of a separation between concepts and empirical realities. For example, it would be interesting to take certain examples of where an adaptive environmental assessment and management approach was adopted, such as Conway's (1987) work on agriculture in Third World countries, to test to what extent the results could help an understanding of the utility of the method's contribution to achieving the concepts of sustainable development.

There is now a great deal of discussion taking place at international conferences, seminars, and symposia on the concept and potential utility of sustainable development. There is, sadly, far less action with regard to its implementation, although it is encouraging to note that in a number of Natural Conservation Strategies, such as the one in Zimbabwe, the concept is at least being advocated. A vast chasm exists between those formulating the concept (and, as in the discussion paper, suggesting frameworks that might implement it),

and those working at "the coal face." In developing countries, these would include political and administrative decision-makers, practitioners of environmental assessment, planning and management, developers, and scientists and other interested parties. This is in no way to decry the utility of formulating the concepts but is more a plea that the ideas be expressed in a simple and clear manner that can be readily understood by all of the interested parties. Until this is done, there is unlikely to be any real advance in trying to adopt some of the potential benefits of the frameworks explored in the discussion paper except at the abstract and conceptual level.

Exploring Other Frameworks

What follows are a number of thoughts as to other avenues that could usefully be explored regarding frameworks that might have potential utility in helping to achieve sustainable development. These are based on this writer's working experience with aspects of environmental assessment and management in a decision-making framework where the concept is closely allied to its ability to contribute to land use planning and control of development activities. This seems to be entirely legitimate given that planning is explicitly named in the discussion paper but not explored to the same extent as environmental assessment frameworks!

In most European countries, environmental impact assessment has been applied at the project level. This is confirmed by the EEC Directive on the Assessment of the Environmental Effects of Certain Public and Private Projects, which became law on July 3, 1988. Initially, it was hoped that the Directive would apply to policies, programs, and plans, but with political opposition this was soon rejected and it was geared exclusively to projects. Although "tokenism" is paid in the Directive to some of the broader themes encompassed by the concept of sustainable development, it is not likely to be a strong feature of the Directive.

Of far greater potential is the possibility of applying environmental assessment to the actual formulation of land use policies. This can be seen as a "proactive" as opposed to "reactive" role of environmental impact assessment in a land use decision-making framework. A number of studies can be identified in the United Kingdom where such an approach has been adopted. Although none explicitly develop the notion that their purpose is to achieve sustainable development, it is strongly felt that there is great potential to view this as a logical next step. Examples include regional studies to identify sites in advance of demand for the optimum location of major development

activities, in which economic, social, and environmental factors are all assessed, and evaluations of optimum strategies for the restoration of derelict land. Far less successful has been the application of environmental impact assessment to the actual formulation of land use plans, where attempts have been made to show that plans are, in effect, "bundles of policies" comprising discrete project elements which could therefore be subjected to environmental assessment.

In the context of land use planning, other approaches that might be worth exploring as a framework include land suitability assessment, agro-ecological zoning and life zone classifications. As already mentioned, the concept of integrated rural development as currently being implemented by the EEC, for example, in the Western Isles of Scotland, did include an environmental assessment component when the program was formulated.

At national levels of planning, in particular in developing countries, a number of frameworks have been utilized and could be explored as to their utility. These include "Country Environmental Profiles," which so far, appear to be strong on description but weak on prescription, and "Country Strategy Studies" being developed by the Asian Development Bank. At a regional level, the concept of ecological profiling could also be usefully explored.

As the concept of sustainability requires a far greater integration of economic, environmental and other components, it would be appropriate to consider the work being done by the East/West Centre into the integration of cost-benefit analysis, EIA, and resource management (Dixon *et al.* 1988).

There would also be merit in considering certain of the more recent developments in evaluation techniques. Specifically, the somewhat controversial concept of rapid assessment, developed by the World Health Organization and linked to environmental impact assessment through work currently being undertaken by the University of Aberdeen's Centre for Environmental Management and Planning, is one possible line that could be pursued. Also, likely to be of great importance in the future, is the concept of Best Practicable Environmental Options (BPEO). The British government sees this as a key element in their environmental policy formulation in the years that lie ahead. Studies of the links between environmental impact assessment and BPEO are now being formulated, and it would be useful to further explore this relationship in the context of achieving sustainable development.

The Next Steps

Gardner's paper is stimulating and innovative and raises many important issues. The above comments reflect a desire to see some of these spelled out in more detail to give clarity to the complex subject area she explores. Specifically, it is suggested that there are a number of areas worth evaluating which would complement those suggested in the above sections. One such approach might be to take a number of recent studies such as the Banff/CIDA, Negril and Barbados Studies (Sadler 1988) or the Dalayan Tourist Complex Redevelopment Study (undertaken by the Centre for Environmental Management and Planning) in Turkey, and test certain of the postulated frameworks as to how they might be applied, and how optimum mechanisms might be established to help achieve sustainable development. This would help link the conceptual with the applied and could probably be best undertaken through a workshop at which all interested parties were present.

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Part II

Evaluation of Paradigm and Philosophy

A "second opinion" is sought on the interrelationships of sustainable development and environmental assessment (EA) in this section. The set of papers by William Rees, Peter Boothroyd, and Christian de Laet explore further the notions of ecological and social sustainability and their implications for the conventional philosophy and practice of impact assessment and development planning. Both Rees and Boothroyd are long-standing critics of the federal EARP. They ask questions as to how well this and similar systems work in meeting the fundamental challenges of achieving sustainable development. De Laet probes more deeply into the relationship and its links to Canadian political culture.

In the final analysis, the concerns expressed about present patterns of resource use are about limits to growth. Resource constraints, the capacities of natural systems to support human activities, are still highly uncertain and interpreted differently by technological optimists and ecological pessimists. How we deal with this uncertainty, whether we should err on the side of caution, and what this means for EA, planning and management, are issues highlighted by Rees. They are important in their own right, and also bear upon the distributive concerns of equity and fairness which Boothroyd places at the heart of social and cultural sustainability. Ecological sustainability, if it encompasses real limits to economic growth that cannot be overcome by technology and substitution in the forseeable future, presents some very thorny questions about the prospects for achieving inter- and intra-generational equity. This contradiction is one that the Brundtland report does not address convincingly and one that we must now confront.

Economics, Ecology, and the Role of Environmental Assessment in Achieving Sustainable Development

William E. Rees

Introduction

This paper has been prepared as part of the Canadian Environmental Assessment Research Council's on-going assessment of the role and placement of environmental assessment in support of sustainable development. Specifically, the author was a participant in a Council-sponsored western "round table" discussion based on a background paper by Julia Gardner. The present paper reflects the author's thoughts on impact assessment in relation to sustainable development as stimulated by the CEARC round table and conditioned by 14-years' experience in doing, teaching, and researching impact assessment. (A revised version was published as Rees 1990.)

Background to the Analysis

This paper suggests some conceptual and practical ways of using environmental assessment to further so-called "sustainable development." To achieve this end, some discussion of the political and economic context of the current man-environment dilemma, basic ecological realities, and prevailing definitions of key concepts is necessary.

The Political-Economic Context

The "world view" that dominates western political economy has its recent roots in 19th-century scientific materialism. The last century saw an unprecedented expansion of science and technology, and with it the flowering of industrialization and material production. Scientific rationality and technological efficiency became the primary measures of social progress and, while science became associated with a glowing material future, traditional values were scorned as obsolete and reactionary. The scientific world view succeeded in separating measurement and quantitative analysis (factual knowledge) from values, and asserted the primacy of the former over the latter.

This rational, utilitarian philosophy remains the dominant paradigm of western political economy today. To judge from economic behaviour, society as a whole sees the physical world and the biosphere mainly as a resource base to be exploited to satisfy the material needs and wants of humankind. At the same time, more than at any other time in recent history, Canadians are being asked to accept economic efficiency and the rigorous discipline of the marketplace as the wellspring of value and the primary determinant of social well-being.[1]

In this climate, it is not surprising that businessmen and technocrats are the heroes of the new age and the most prominent role models for youth. The competitive ethic of the (preferably) free-market economy provides the accepted standard for proving individual self-worth, with success measured in terms of conspicuous consumption and the accumulation of personal property. In some circles, it is fashionable to be socially unconcerned and aggressively oblivious to environmental destruction. While individual rights are loudly proclaimed, there is embarrassing silence over matters of social responsibility.

Reductionist mechanistic science remains our dominant analytic mode. Consequently, society's prevailing ecological myth sees "environment" in terms of isolated, individual resources or, at best, as a mechanical construction, bendable to human will and purpose. The organization of government reflects this perspective, breaking the environment into component parts (e.g., fisheries, forestry, land and waters, energy, etc.) with little regard to properties of the whole and leaving the Department of Environment with little to do!

"Modern" economics is also cast from the mechanical mold. The founders of the neoclassical school, impressed with the spectacular successes of Newtonian physics, strove to create economics as a sister science, "the mechanics of utility and self-interest" (Jevons 1979).The major consequence of this mechanical analogue is a view of economic process as "a self-sustaining circular flow between production and consumption within a completely closed system." By this perception, "everything ... turns out to be just a pendulum movement. One business cycle follows another... If events alter the supply and demand propensities, the economic world returns to its previous position as soon as these events fade out." In short, "complete reversibility is the general rule, just as in mechanics" (Georgescu-Roegen 1975).

[1] The Canada-U.S. Free Trade Agreement is perhaps the most recent best example since it is designed explicitly to foster a market-driven North American economy.

An important corollary of this equilibrium theory is that the self-evident, continuous exchange of material resources, and the unidirectional flow of free energy between the economic process and the material environment, carries no weight with the neoclassical economies. From this perspective, resources are supplied not by nature but by human ingenuity. According to Solow (1974), "the world can, in effect, get along without natural resources". Similarly, any damage to environmental processes caused by human activity is assumed to be inconsequential or, in any event, totally reversible.

This belief creates a second major spin-off from the equilibrium model — continuous growth becomes theoretically possible. Indeed, latter day economists seem to believe "not only in the possibility of continuous material growth, but in its axiomatic necessity" (Georgescu-Roegen 1977). This "growthmania" (Mishan 1967) "has given rise to an immense literature in which exponential growth is taken as the normal state of affairs" (Georgescu-Roegen 1977).

That modern socio-economic systems are driven by the positive feedback of exponential growth (i.e., the compound interest function) is evident from a glance at the business pages of any daily newspaper. The annual percent increase in gross national product (GNP) is taken as every nation's primary indicator of national well-being. Rates of under 3% are considered sluggish, and politicians and economic planners don't feel at ease until growth in GNP approaches 4-5% per annum. While such rates may seem modest, a 4% increase implies a doubling of economic activity in a mere 17 years!

In the context of this paper, it is worth noting that in capitalist states, governments depend on the constantly increasing size of the national economic pie to ensure that the poorer classes receive a sufficient share of national wealth to survive. Growth relieves the pressure for redistributive policies.

The Ecological Reality

There are two ecological problems with these commonplace economic expectations. First, the expanding economic system is inextricably linked to the biosphere. Every economy draws on the physical environment for various non-renewable (stock) resources and on ecosystems for an array of renewable resources, and *all* the products of economic activity, both the waste products of the manufacturing process and the final consumer goods, are eventually discharged back into the biosphere as waste.

The ultimate regulator of this activity, and one that modern economic theory essentially ignores, is the second law of thermodynamics or the entropy law: *In any closed isolated system, available energy and matter are continuously and irrevocably degraded to the unavailable state.*—(see Georgescu-Roegen 1975, 1977). The effect of this law is to declare that all so-called economic "production" is really "consumption"!

All modern economies are dependent on fixed stocks of material and energy resources. Thus, the second law dictates that they necessarily consume and degrade the very resource base that sustains them. The substitution of one depleting resource for another can only be a stopgap on the road to scarcity.

Even resource recycling has a net negative impact on remaining stocks of available energy and material. In short, all economic activity contributes to a constant increase in global net entropy (disorder) through the continuous dissipation of free energy and matter. Contrary to the assumptions of theory, *there is no equilibrium of any sort in the material relationship between the economy and the environment.*

This means that the growth of many national economies, such as Japan, can be sustained only by continuous resource imports from elsewhere, and only in the short run. The global economy, for all practical purposes, is a closed system, and this reality is little affected by shuffling resources around (world trade). Thermodynamic law sets an absolute limit on the material growth of the world economy. Thus, contrary to the implicit assumptions of neoclassical economics, sustainable development based on prevailing patterns of resource use is not even theoretically conceivable.

The second ecological difficulty with the growth-dependent economy pertains to the functioning of ecosystems themselves. Ecosystems, like economic systems, depend on fixed stocks of material resources. However, the material resources of ecosystems are constantly being transformed and recycled throughout the system via food-webs at the local level, and biogeochemical cycles on a global scale. In addition, evolution and succession in nature tend toward ever greater order and complexity.

The material cycles and developmental trends of ecosystems appear at first glance to defy the thermodynamic law. Ecosystems *seem* to be inherently self-sustaining and self-organizing, and therefore to contribute to a reduction in global net entropy. This is possible only

because ecosystems, unlike economic systems, are driven by an *external* source of free energy, the sun. Through photosynthesis, the steady stream of solar energy sustains essentially all biological productivity and makes possible the diversity of living things on earth.

Material recycling — the self-renewing property of ecosystems — is therefore the source of all renewable resources used by the human economy. Moreover, since the flow of solar radiation is constant, steady, and reliable, resource production from the ecological sector is potentially sustainable over any time-scale relevant to humankind.

But only potentially. Even ecological productivity is ultimately limited, in part, by the rate of energy input (the "solar flux") itself. Ecosystems, therefore, do not grow indefinitely. Unlike the economy, which expands through intrinsic positive feedback, ecosystems are held in "steady-state" or dynamic equilibrium, regulated by limiting factors and negative feedback.

Human beings and their economies are now a dominant component of all the world's major ecosystems. Since these economies are growing and the ecosystems upon which they are dependent are not, the consumption of ecological resources everywhere threatens to exceed sustainable rates of biological production.

This situation is exacerbated by pollution, which poisons or otherwise impairs the remaining productivity of ecosystems.[2] In other words, modern industrial economies both directly undermine the potential for sustainable development through over-harvesting, and indirectly compromise future production through residuals discharge. Recent reports that acid rain may be reducing rates of tree growth by as much as 25% in parts of eastern Canada serve as a timely example.

Given the realities of economy-environment interaction, the relevant question becomes: How long can the current economy even be maintained at its present level (forget about growth!); or better, how long have we got to develop and adjust to an economic and development mode with a more promising future?[3]

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[2] It is instructive to think of pollution as the result of the inevitable degradation and dissipation of matter and energy associated with industrial economies. *Pollution is entropy law at work.*

[3] For an elaboration of the concepts in this section and 25 principles for sustainable development, see Rees 1990.

On Sustainable Development

There is not a commonly accepted or operational definition of "sustainable development." However, common sense suggests that it is any form of planned change that can be maintained indefinitely. Thus, *sustainable development is development that does not erode the ecological, social, or political systems upon which it is dependent.* Planning for sustainable development must, therefore, explicitly acknowledge ecological constraints on the economy, and have the full understanding and support of the people. This in turn suggests the need for political and planning processes that are informed, open, and fair.

Equity is also a central consideration. The World Commission on Environment and Development (1987:33) reported that the 26% of the world's population living in developed countries consumes 80-86% of non-renewable resources and 34-53% of food products. The nature of emerging ecological and social constraints suggests that reducing the present gap in standards of living between the rich and poor, between and within nations, will almost certainly require that the rich reduce both present consumption and future expectations so that the poor may enjoy a fairer share of the world's resources.[4]

The National Task Force on Environment and the Economy (NTFEE) took rather a different tack. NTFEE defined sustainable development as "development which ensures that the utilization of resources and the environment today does not damage prospects for their use by future generations." The report goes on to state that at the core of the concept is the requirement "that current practices should not diminish the possibility of maintaining or improving living standards in the future." Also: "Sustainable development does not require the preservation of the current stock of natural resources or any particular mix of ... assets. Nor does it place artificial limits on economic growth, provided that such growth is economically and environmentally sustainable" (National Task Force on Environment and Economy 1987:3).

This definition is self-contradictory and thus impossible to interpret rationally. First, as previously emphasized, the present generation cannot use any stock energy or material resource such as oil, natural gas, and phosphate ore, without *totally eliminating* the prospect for their use by future generations.

[4] The foregoing basic points are implicit in the "principles" for sustainable development presented by Gardner in her background paper.

Thus, the main part of the definition is simply invalid. Second, there is obvious reluctance on the part of the Task Force to admit the possibility that living standards for some may have to be reduced that others might live at all. Indeed, the report avoids the equity issue entirely. Third, and consistent with the foregoing, this definition clings to the economic growth ethic and disallows the possiblity that the preservation of certain "mixes" of ecological resource systems might be essential to sustainability. Clearly, continued growth remains the NTFEE's implicit solution to social inequity. Finally, although no one advocates "artificial" limits to growth, surely there are circumstances in which we might need *real* ones!

In sum, while the NTFEE report provides many valuable suggestions for improved environment and resource management, its definition of sustainable development could be used to defend practically any pattern of economic activity, including the status quo.

Sustainable and Unsustainable Development: Some Examples

Using our original definition, here are some examples of sustainable forms of development:

- aid programs that empower local people in the Third World to increase food production using technology appropriate to local ecological conditions;
- development programs that respect and enhance local adaptations to prevailing ecological conditions. For example, nomadism in sub-Sahelian Africa was a cultural ecological adaptation to seasonal shifts in rainfall. In contrast, aid-abetted settlement has contributed to over-grazing, desertification, and recent famines in North Africa);
- limited or no-tillage organic agriculture;
- resource co-management programs that place priority on native subsistence requirements ahead of commercial or recreational demand;
- development designed to displace non-renewable forms of energy with renewable solar-based forms (e.g., wind and photovoltaic electricity generation, and solar heating economies, either high-tech or low-tech) may be the only sustainable economies;
- community development as practised by Amish, Mennonite or other sects who disavow labour-displacing, land-destroying technological innovations in favour of human and animal labour. Some "Old Older" communities are essentially solar-based.

Examples of unsustainable development activities include:

- aid programs that facilitate the concentration of land ownership, undermine local staples production, and encourage cash cropping for export which is often required to earn money to pay off the "development" loan;

- related to the above, the introduction of technological "innovation" from the north temperate zone such as gasoline-powered machinery, irrigation schemes and chemical fertilizers that may be ecologically inappropriate for arid, semi-arid, tropical, and sub-tropical ecosystems;

- current machine and energy-subsidized practices in first-world agriculture managed under financial and market conditions that force farmers to mine the soil.[5] Canadian farmers have reduced the organic and natural nutrient content of prairie soils by 50-60% in 70 years. Typical soil loss from cultivated lands in the United States and Canada amounts to 9-12 tons/acre/year (20 metric tonnes/ha) or as much as 10 times the sustainable rate (see SCC 1986; Pimental *et al.* 1976);

- irrigation schemes that produce short-term gains, and dependencies, but eventually lead to destructive salination of the soil;

- use of chemical fertilizers that produce short-term gains but lead eventually to loss of production due to soil acidification;

- destruction of tropical rain forests for agricultural settlement in laterite soil areas. In this instance, most of the essential nutrients are contained in the tree biomass, are lost in logging or burning;

- projects to displace petroleum-based automotive fuels with alcohol derived from energy crops, at the expense of staple food production for local people. This is a growing controversy in Brazil;

- hydro-electric/irrigation projects that initially boost production and create dependencies, but which fail when the reservoirs fill up with sediment often produced by unsustainable forestry or agricultural practices. This situation is common in the Third World;

[5] Ironically, the WCED report advocates additional economic growth in the Third World in part to produce the economic surpluses needed for sustainable management of the renewable resource base. This situation does not yet pertain in much of the developed world where farmers are forced to the wall by the economics of high-tech agriculture.

- market-driven fisheries and forestry practices that have led to stock depletion and destruction of future productive capacity almost everywhere, including Canada;[6]

- the current type and levels of economic activity and technology producing continuous deterioration in key environmental quality indicators such as the build-up of carbon dioxide, other greenhouse gases and acid rain.

The Scope and Current Practice of Environmental Assessment in Relation to Sustainable Development

Clearly, if environmental assessment (EA) is going to make a significant contribution to sustainable development, assessment activities should include consideration of the full range of policy and project-related activities implied by the above examples. This raises the question of the current scope of EA in Canada and elsewhere.

Most references to formal environmental assessment refer to the set of activities designed to identify, predict, and evaluate the likely environmental consequences of a specified development or policy proposal. For example, according to the Guidelines Order describing the Canadian federal Environmental Assessment and Review Process (EARP), the process theoretically applies to "*any proposal* for which the Government of Canada makes a financial commitment" or "that is located on any lands... that are administered by the Government of Canada" (emphasis added). The term "proposal" means "any initiative, undertaking, or activity for which the Government of Canada has a decision-making responsibility" (Canada 1984).

This language is clear and unambiguous. A rational person reading the Guidelines Order would be justified in believing that all environmentally significant federal projects, programs, policies, and routine regulatory or management activities are already being systematically assessed for environmental effects, and adjusted accordingly.

This is a false impression. In practice, from the beginnings of EARP in 1974, the only activities that have actually been assessed are a limited number of area-specific projects, primarily projects involving

[6] Contrary to present orthodoxy, even private ownership would not necessarily resolve this dilemma. While it might be ecologically disastrous, it is economically more efficient for the "owner" of a renewable resource to liquidate that resource if by so doing s/he could obtain a higher return by investing the proceeds in some alternative economic activity than by husbanding the resource (Clark 1973).

physical disturbance of the environment. Moreover, the design of the federal EARP ensures that impact assessment is conducted largely on a reactive, project-by-project, predictive, and short-term basis. Monitoring of any kind has yet to be generally accepted as a necessary companion to impact assessment, and to this author's knowledge, there is no example of an explicitly designed cumulative effects assessment and management project in Canada. The situation is little different at the provincial level or in other countries.

There are two important implications of this situation from the perspective of using environmental assessment in sustainable development. First, EA in Canada does not even address the most important public initiatives affecting environmental quality. While capital projects do often have significant environmental effects, the impacts of national and provincial policy decisions, regulations, and routine management procedures, collectively are vastly greater, but are, as yet, left out of the process. It should be noted, that existing impact assessment processes generally do not apply to purely private sector proposals.

Consider the cumulative environmental impacts of the wide array of policy, regulatory, and management initiatives in such matters as transportation and road maintenance; energy conservation and tax incentives related to write-offs and depletion allowances for oil and gas development; agricultural technology such as irrigation, cultivation, pesticide and herbicide use, and soil management; forestry, mining and fisheries; urbanization and disposal of urban wastes; and international trade. There is no evidence that any environmentally significant policy or program in any of these areas has ever been rigorously screened, let alone referred for public review. Even the NTFEE advocates the extension of EA to policy proposals.

The second problem with current EA practice is that the dominant project-oriented, one-shot, prediction-based approach is ecologically naive and wholly inappropriate for the requirements of sustainable development. The current conception is a reactive one in which the economy is considered to be the independent or driving variable, and EA is the dependent variable. What is required is a proactive approach in which the requirement of sustainability is the driving consideration and the permissible level of economic activity is the dependent variable.

Finally, the problems with EARP are not restricted to scope or questionable scientific assumptions. The fact is that the existing EARP is not applied rigorously even to physical projects. This can be

ascribed to the largely discretionary nature of the process as it is based essentially on voluntary self-assessment, the predominantly growth-oriented ideology of successive federal governments, the generally low political status of environmental issues, and an institutional framework that seems designed to circumvent political accountability (Rees and Boothroyd 1987a, b).

All this suggests three essential steps in creating a role for EA in achieving sustainable development:

- extend the scope of the assessment-related activities to cover the full range of ecologically and socially relevant government and private sector activities;
- develop methods for EA that reflect the temporal (long-term) and spatial (regional/global) requirements of sustainable development and resource management; and
- create institutional frameworks for EA that are open, informed, balanced, and designed to promote political accountability. A diversity of frameworks are required to reflect the diverse nature of initiatives and activities that should be assessed (Rees and Boothroyd 1987b).

The following section suggests an appropriate conceptual framework for EA in the context of sustainable development.

A Planning Framework for Sustainable Development

Cumulative Environmental Effects and Assessment

A major force behind the drive for sustainable forms of development is increasing concern about so-called cumulative environmental and social impacts of economic activity and growth. These can be felt at all spatial scales from local to global. Sometimes we are concerned about cumulative changes in single variables from a variety of similar sources, sometimes with the impacts on numerous variables from various unrelated activities.

Cumulative impacts result from the additive or synergistic effects of numerous incremental actions, including a major contribution from the routine functioning of government and society. The latter are usually ignored as individually too small to be considered in formal environmental reviews (see previous section).

Often society takes little notice of gradual changes in environmental parameters until it is too late for effective mitigative action.

Sometimes, on the other hand, the great resilience of ecosystems enables them to "absorb" incremental impacts for long periods without obvious ill effect. This leads to a false sense of security that all is well, when in fact society has been led into an ecological trap. In either case, social inaction means that a straw is added that breaks the proverbial camel's back. A species, a valuable fishery, or a whole ecosystem may be lost forever.

Many of the most potentially serious regional or global scale environmental problems such as disappearing forests, acid rain damage, the thinning ozone layer, and rising carbon dioxide levels are the cumulative result of an array of expanding economic activities around the world. Some of these trends have the potential to inflict inestimable damage on whole regions, or even globally. This means that it is the whole present pattern of growth-driven economic development, not just some particular project or economic sector that is unsustainable.

To the extent that such cumulative trends portend real threats to survival, the appropriate response may require a reassessment of the values, beliefs, and assumptions upon which the near-universal growth model of economic well-being is founded. Minor adjustments at the level of improved environmental regulation and pollution control techniques are simply inadequate. Whatever else may be required, environmental assessment will certainly have to break out of its current limited conceptual and practical boundaries if it is to make a significant contribution to cumulative assessment and the achievement of sustainable development in any reasonable form.

Regional Carrying Capacity

The notion of cumulative effects has no practical utility unless it is in relation to permissible limits of ecological or social impact. This in turn implies the existence of limits to development and economic activity that are best understood at the regional level. Indeed, it is a premise of this paper that the management of cumulative effects can best be facilitated by adoption of a regional-scale planning framework.

Implicit in the relationship between cumulative effects and environmental limits is the concept of carrying capacity. Planning and development within the limits of carrying capacity recognize that humankind is still dependent on the productive capacity of ecosystems of the biosphere on a global scale, and that some minimal level of ecosystems integrity is therefore essential to human survival.[7]

[7] For two views of the utility of this concept, see World Bank (1985).

For most animal species, carrying capacity is defined as the maximum population that can be supported indefinitely in a given habitat without permanently impairing the productivity of the ecosystem(s) upon which it is dependent. For human society, regional carrying capacity can be defined as the maximum rate of resource consumption and waste discharge that can be sustained indefinitely in a defined impact region without progressively impairing bioproductivity and ecological integrity. The corresponding population depends on standards of living, i.e., mean per capita rates of resource consumption and waste production.

It should be noted that while human society depends on many ecological resources and functions for survival, carrying capacity is ultimately determined by the single vital resource or function in least supply. Indeed, loss of the ozone layer alone could do us in.

An understanding of carrying capacity provides a functional definition of sustainable development. In ecological terms, any level of development or economic activity that does not exceed the carrying capacity of a management region is sustainable.[8] Conversely, development or economic activity that consistently degrades the ecosystems upon which the regional population is dependent is not sustainable in the long run.

While this framework is conceptually simple, various factors make it difficult to put in operation. For example, inter-regional flows and commercial trade in ecological goods and services obscure the immediate people/land relationship.[9] Because they can import nature's products from outside their own territory, the population of a given region may unknowingly exceed its local carrying capacity with apparent impunity. In the absence of immediate feedback from t' land on their lifestyles or economy, there is not direct incentive f or that population to practice sustainable management of local resources. The psychological effect is that people tend to forget their "obligate dependency" on the natural environment. Why should

[8] As Gardner details in her background paper, ecological integrity is only one of many characteristics that may be desirable for sustainable development, particularly if it is to be fair and equitable. However, unlike some other factors, ecological integrity is absolutely necessary from the outset, and so is highlighted here. Like carrying capacity, sustainability is ultimately dependent on its weakest necessary component.

[9] This includes the movement of air and water in natural cycles throughout the biosphere, and import/export trade in fisheries, forestry, and agricultural products. It should be remembered of course, that ecological trade is a zero-sum game that cannot relieve overall (global) scarcity.

Ontarians be concerned about the urbanization of prime farmland in the Golden Horseshoe if they assume they can always import food from Mexico and California?

The fact is, however, that as one region's population destroys its own environment, it becomes dependent on apparent excess carrying capacity imported from other regions, over which it has no direct management control. This last point becomes important if: (a) there is no permanent commitment by the export region(s) to the dependent region; and (b) management practices in the export region(s) are degrading the ecological resource base. In the case in the Ontario/California example, farming practices in California, the most productive agricultural region of the United States, exceed carrying capacity as defined above, and are therefore not sustainable.

While inter-regional trade makes it more difficult to implement a carrying capacity model by removing direct incentives, it does not make it impossible. For example, if each region were managed without progressive local ecological degradation, regardless of import-export relationships or the distribution of dependent populations, the cumulative effect would be global sustainable development.

In these circumstances, of course, the populations of surplus regions which are engaged in export trade would not be able to rise to the level of their own regional carrying capacity without jeopardizing people in dependent import regions. For this reason, inhabitants of dependent regions would probably want to contractually formalize their relationships with those areas from which they import carrying capacity, in order to ensure the sustainability of that relationship.

A Role for Environmental Assessment

Sustainable development recognizes that any persistent deterioration in key ecological variables cannot be tolerated. To achieve sustainable levels of economic activity within carrying capacity, society will have to adopt much more rigorous and deterministic approaches to regional planning. Long-term ecological factors rather than short-term market forces would be the primary determinants of land use and resource management decisions as limits are approached.

Each planning region would therefore have to establish a comprehensive ambient environmental quality monitoring program to identify unsustainable trends in key environmental quality and productivity indicators based on ecologically significant parameters of air, soil,

and water quality. It would also have to track land development patterns to ensure conformity with planning criteria for sustainable use.

This is not a trivial task. In effect, comprehensive regional monitoring is an operational form of cumulative environmental assessment (CEA). Within the carrying capacity-sustainable development framework, CEA can be seen as a means to estimate how close we are to developmental limits that would be identified and imposed by the regional plan.

This approach also provides the missing context for project-specific EA. Critics of "traditional" EA have long complained that in the absence of a broader policy and planning context, it is impossible to assess the significance of impacts associated with isolated single projects. By contrast, within the carrying capacity framework, individual project impacts could be evaluated, as they should be, in light of preceding planned development and the remaining capacity of biophysical and social systems to cope with additional stress. At the same time, project-specific assessments would provide data for the on-going cumulative environmental assessment program, and an opportunity to test specific hypotheses on environment-development relationships.

It should be noted that such difficult-to-manage factors as standard of living, the sophistication of production and pollution control technologies, and per capita consumption all affect the population that can be supported within the carrying capacity of a given system. For example, more people can be supported at lower levels of mean per capita consumption than at higher levels; improved technology that is environmentally benign may sustain more people at a given standard of living, or the same number at a higher standard than before; and reducing population to planned levels may enable everyone to enjoy comfortable living standards within the constraints of regional and global carrying capacity.

Since all these factors are theoretically socially malleable, they may have to become stronger foci for public policy in future as it becomes obvious that environmental limits are being breached. Present attention to the theoretical and practical benefits of cumulative effects assessment is tacit acknowledgement that this is the direction the growth ethic is leading us.

A Case Study

To illustrate the cumulative assessment-carrying capacity (CA-CC) approach, consider the present population and boundaries of British

Columbia. To keep matters simple, we focus on the agricultural resource base, using land area as a surrogate for the whole range of depletable ecological resources upon which agriculture depends, such as nitrates, phosphates, and other nutrients, and soil organic matter.

The first step in the CA-CC exercise would be to determine per capita consumption of agricultural products by British Columbia residents, assuming current Canadian dietary standards, and convert this to the land equivalent. This provides an estimate of the actual land area presently devoted to sustaining each member of the region's population.

Our computation would probably produce a figure close to Borgstrom's (1973) for North America, showing that each of us "consumes" approximately 1.8 acres of cropland and 3.2 acres of pastureland for a total of 5 acres (about 2.2 hectares) on a continuous basis. This means that some 14 million acres (5.66 million hectares) of mixed farmlands are required to support British Columbia's current population of 2.8 million. We now have a crude "cumulative assessment" of the agricultural land requirements for sustainable development at current dietary standards.

It may be a surprise to some that there are only about 6 million acres devoted to food production in all of British Columbia, and this includes all the best arable land. This amounts to only 2.14 acres/per capita (.86 hectares) or less than half the estimated land requirements for the resident population. It is not so surprising, therefore, that the province regularly imports over half of its food requirements, including many crops grown there.

We have now shown that the estimated cumulative demand for land by the present population far exceeds the carrying capacity of British Columbia at current living standards. This estimate is based on only a single indicator of land consumption.[10]

This simple exercise illustrates the value of the CA-CC approach by raising a whole range of issues that are not normally the subject of serious policy consideration. For example, should British Columbia really be considered under-populated? What does it mean for land use and population policy when half of the agricultural resource base supporting the subject population is in the form of apparent excess

[10] Note also that this simple illustration takes no account of erosion, salination, acidification and other problems that are steadily reducing the area and capacity of land in production. Current land management practices are not sustainable.

capacity elsewhere? Should we be concerned that this so-called "ghost acreage" (Borgstrom 1973) is under someone else's political and economic control? What are the additional implications for achieving sustainable development when much of the agricultural land in question, both in British Columbia and elsewhere, is being seriously degraded by agriculture itself?

Faced with these long-term questions, even the most strongly market-oriented planners might begin to think that perhaps land economics, with its short-term perspective and assumption of complete reversibility, may not be the most important consideration in agricultural land use policy after all.

The CA-CC approach could be used to assess the cumulative regional consumption (ecological demand) and production (carrying capacity) of a wide range of ecological goods and services. At increasingly fine-grained levels of analysis, these might range from market commodities such as forest products, to more fundamental ecosystems components not recognized *per se* in the marketplace, such as atmospheric oxygen or essential nutrients.[11] The relationship between cumulative demand and regional capacity respecting each key component would identify those vital ecological resources and functions in greatest danger of over-exploitation. Hence, the CA-CC framework would provide the empirical basis for policy and management initiatives to restore sustainable development.

Such data also make it possible to build up a crude estimate of the ecological "balance of trade" for any region, however defined, with the rest of the biosphere. This would provide the additional advantage of graphically illustrating inter-regional dependencies and possibly garnering public support for the more onerous implications of sustainable development.

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[11] Some of these may be contained in marketed commodities but are not themselves recognized as the *de facto* critical resource(s). For example, we export "grain," but are not accustomed to thinking of it as the phosphates, nitrates, organic matter, etc., effectively removed from the soil in the process. This is how agriculture can become very much a form of mining, and just as non-renewable.

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On Using Environmental Assessment to Promote Fair Sustainable Development

Peter Boothroyd

Introduction

The purpose of this paper is to discuss ways to improve the role of environmental assessment in supporting fair sustainable development. It begins by defining how the terms "fair sustainable development" and "environmental assessment" are used in this paper.

Fair Sustainable Development

Sustainable development can be defined most generally as purposive social change in which short-term benefits do not reduce long-term opportunities.

This paper considers a subset of sustainable development: *fair* sustainable development. Fair sustainable development (FSD) is defined as change that immediately improves the standard of living for the poorest throughout the world without foreclosing their opportunities to maintain their rising standard of living.

It is assumed in this paper that FSD requires the rich to reduce their consumption. This assumption will be rejected by the many who think that we can have infinite win-win development, that the rich and the poor can both consume infinitely more, that the total pie can expand without the pieces ever having to be redistributed.

While it is not within the scope of this paper to argue extensively with that view, two points should be made. The first is that a continuing wide discrepancy in standards of living does not fit my definition of fair. The second point, which is more cogent in a discussion of sustainable development, is that it appears clear that the pie cannot continuously be expanded for any reason, whether to promote or avoid redistribution.[1]

[1] Oil is but one example of a resource for which production levels cannot be continuously increased as an alternative to redistributing supplies within present levels. North Americans burn twenty-four barrels of oil per year per capita while the rest of the world consumes three. In order to enable the rest of the world just to drive cars as much as North Americans do, world oil production would have to be quadrupled. This would be environmentally problematic even if it were physically possible. If there are technological fixes to this problem of disparity, they remain distant. In the meantime, if our world economy is to be fair and sustainable, the rich must quickly and significantly curtail their consumption of rapidly dwindling oil.

The paper also assumes that while *un*fair sustainable development is conceivable, it is so immoral and so practically impossible that it should not be considered as an option.[2] It is practically impossible because a world police force would be required to carry out the almost impossible task of forcing the poor to live ecologically soundly and to stay poor so that the rich could consume more than their fair share. It is unlikely that the poor could be kept from meeting their immediate needs regardless of the cost to the rich and the environment.

Of course, most of the rich, including most Canadians, do not agree that what is being called here "unfair sustainable" development is unfair. That is, they do not think they have a moral responsibility to reduce immense standard of living differentials, either because they are morally underdeveloped, or because they do not see the relationship between their riches and poverty, or because they rationalize that the expanding pie will provide the fix. They also do not agree that unfair sustainable development is practically impossible, in most cases because they have not thought about the difficulties of maintaining world-wide repression.[3]

Examples of actions that lead to FSD are: limiting automobile driving and improving public transit, taxing coffee as a high luxury good and using the proceeds to fund redevelopment of coffee plantations into vegetable plots, giving preference to native food fisheries over commercial harvesters, replacing prairie monoculture with ecologically sound mixed farming, taxing restaurant meals and putting the funds into nutrition supplements to improve the long-run health and productivity of welfare recipients, and developing an international program for managing and distributing oil on a need rather than market basis.

Examples of actions that may lead to sustainable development for one society but that are unfair because of their impacts on the rest of the world are: limiting use of poisons at home but permitting their export to poor countries, developing agricultural policies that assume continued reliance of other countries on Canadian grain, and

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[2] Sustainability and fairness are conceptually independent dimensions. Unfair unsustainable development — the worst case — is what we have now. Fair unsustainable development is logically impossible if we define fair as including inter-generational fairness.

[3] Garrett Hardin (1968) is a rare example of a person who has thought about these matters and approaches coming out in favour of unfair sustainable development. He sees it as a lesser evil than our current unfair unsustainable development ("lifeboat ethics").

enhancing salmon production for the benefit of large commercial interests while severely limiting native food fisheries.[4]

Environmental Assessment

Environmental assessment can be defined as comprising both reactive processes (environmental impact assessment (EIA)) and proactive processes (carrying capacity assessment). In this paper only the former is discussed, although in the conclusion its relationship to the latter is noted.

The term EIA in this paper refers to formally prescribed systematic public processes for assessing ecological and social impacts of possible public decisions. By public processes is meant processes subject to public scrutiny, through lists of screening decisions and public availability of initial assessment reports, and public input such as through hearings, panels and consultations.

Improving EIA to Support FSD

There are three ways EIA can be improved to support FSD.

- The application of EIA (what is assessed) can be expanded to policies, regulations, and managerial decisions.
- The process of EIA (how assessment is done) can be made more public, fair, and interactive.
- The questions asked in EIA (why assessment is done) can address more fundamental issues.

Application Improvements

EIA's application should be expanded beyond its present project orientation. If EIA is to help us recognize and deal with the cumulative effects that threaten FSD, it must also be applied to policies, regulations, and managerial practices. At present, these are not subjected to EIA in practice, though they could be, in principle, under the EIA guidelines of some jurisdictions such as Canada's EARP.

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[4] There are actions oriented toward sustainable development which, when considered generally, appear to be neither necessarily fair nor unfair: e.g., substituting solar heating for non-renewable fuels. The way in which such an apparently neutral action is taken, however, will tilt it one way or the other. For instance, solar heating retrofitting policies may favour large or small homeowners.

The absence of formal EIA from most public planning means that decisions are being made without the benefit of public scrutiny or input. This situation poses three threats to FSD:

- the short-term interest of one group may receive precedence over the long-term sustainability interests of society as a whole;
- a powerful richer group's sustainability may be assumed to be more important than that of less powerful groups; and
- FSD-oriented decisions may be based on faulty information or predictions with no provision for the public to play the corrective role it is capable of.

Fisheries management provides a good example of a public management sector where, many believe, decisions are being taken that threaten FSD in all three ways because of the lack of public EIA in the policy-making and regulating processes. West Coast Indian tribes perceive legalized commercial overharvesting of shellfish both as outside commercial interests getting preference over their food needs and therefore over the sustainability of their communities, and bureaucratic decision-making based on incomplete ecological knowledge.

Thorough public EIA in fisheries management could, if the right questions were asked, minimize the danger of the sustainability criterion being ignored because of the political influence of powerful groups with short-term exploitation interests. Good EIA could even the odds between more powerful interests, such as the tourist industry and seiner fleet owners, and less powerful interests, including gillnet fishers and local shellfish harvesters, when trade-off decisions have to be explicitly made between their respective sustainability interests. For example, policies reflecting the notion that small "inefficient" boats should be weeded out would have to be considered in the light of local communities' reactions. Good EIA could also bring more information and perspectives to bear on planning and reduce the danger that government decisions regarding stock enhancement, habitat protection, and harvesting procedures, limits, and allocations will be made on the basis of limited or inaccurate information and prediction techniques.

The British Columbia Utilities Commission public hearings on the proposed Peace River Site C dam provide a good example of the uses of EIA. The issue of the sustainability of the Peace River valley as a farming community versus the sustainability of the province's hydro export role was raised as a concern by public interest groups and local

residents and the hydro demand forecasts and agriculture-potential analyses of the proponent, British Columbia Hydro, were effectively challenged.[5]

The environmental impacts of the proposed Peace River Dam were carefully assessed through public review in large part because the dam was a discrete project. Unfortunately, energy sector policies, regulations, and day-to-day managerial decisions are not now subject to public scrutiny through EIA even though the accumulation of their impacts may affect our chances of achieving FSD much more than any one project. There should be EIA of energy policies, regulations and managerial decisions related to urban form (and therefore transportation demands for energy), site design (and therefore space-heating demands and supply possibilities for energy), building codes, transportation mode support, industrial fuel choices and efficiencies (related to subsidies), fuel pricing, energy conversion pollution and risks.

There are many other sectors besides fishing and energy where EIA should be applied to policies, regulations, and managerial practices. Here are some of what may be the most important:

- *agriculture* policies, regulations and managerial decisions on land clearing, subsidies, fertilizer, pesticides, herbicides, fallowing, irrigating and grazing, which affect the sustainability of prairie farms;
- *forestry* policies, regulations and managerial decisions related to harvesting practices, fish and wildlife habitat protection, replanting requirements and sylviculture;
- *waste management* policies, regulations and managerial decisions related to recycling, pollution, and land use;
- *land use* policies, regulations and managerial decisions related to appropriate use of fertile land (not just preservation), urban density, settlement locations, habitat preservation, and species conservation; and
- *health care* policies, regulations and managerial decisions on preventive medicine, disease control, drug control (including tobacco, caffeine, nicotine), and physical fitness.

[5] See M. Davidson and P. Boothroyd, "The Site C Social Impact Assessment: Effectiveness of Public Hearings," prepared for a study on "Review and Analysis of Institutional Arrangements under which Social Impact Assessment Studies are Conducted in Canada," through L. J. D'Amore and Associates Ltd., under contract to the Canadian Environmental Assessment Research Council, 1986.

In all these cases, the ecological and social impacts of possible political, regulatory, and managerial decisions should be formally, systematically, and publicly assessed to determine whether they threaten FSD and whether they do as much as they could to enhance that sustainability. In addition to working against bad decisions, each EIA would contribute to raising public consciousness about FSD goals and means. This is a vital contribution because FSD cannot be achieved without heightened public consciousness.

Of course, thousands of public decisions are made daily in this country and not all can be subject to as much attention as the Site C dam proposal. We have to determine which kinds of decisions deserve most attention, and which assessments will give us the most leverage in promoting sustainable development.

It might appear that assessment of proposed and existing *policies* would appear to give us most leverage, but in most cases policy is implicit and therefore not amenable to formal review. In many of those cases where policy is explicit, it does not direct practice. Consider Canada's policy on EARP, for example, which 14 years after its introduction still does not guide departmental practices to any significant degree.[6] The assessment of ineffectual policy is not an efficient use of time. Therefore, the assessment of policy will only occasionally be an effective and efficient use of human resources.

What may offer high leverage more often is the assessment of regulations and those managerial decisions that directly affect public consumption and production practices (e.g., decisions on fishing closures, grazing rights, solar heating subsidies, garbage collection limitations, subdivision densities, cigarette machine placements). Not all of these possible decisions can be nor need be assessed by all publics. What is needed is a process for getting the right people involved in effectively assessing specific decisions.

Process Improvements

The challenge for EIA practitioners is to design formally prescribed processes whereby the most knowledgeable, affected, and concerned publics are:

- given notice of impending decisions of interest to them;

[6] See Rawson Academy of Aquatic Science, in association with W. Rees and P. Boothroyd, "Reform of the EARP Process: Background Paper on EARP Activities" and "Background Paper on EARP Reform: Process and Structure," prepared for the Canadian Environmental Assessment Research Council, 1987.

- offered meaningful opportunity to comment, and in some cases given assistance to comment;
- not only listened to by planners and decision-makers but also replied to;
- enabled to interact honestly and creatively with other interested parties; and
- given media attention.

Such public, fair, and interactive EIA processes will promote FSD because they will widen the debate on any given issue. FSD will be promoted by wider debates because they will improve the quality of immediate decisions, ensuring that as much information as possible, from as many people as have information to contribute, is brought to bear on decisions involving trade-offs between short-term and long-term interests, or between powerful, rich interests and weak, poor interests. The systems we live in, and whose sustainability we affect by our decisions, are so complex that we cannot afford to overlook any relevant knowledge. Public, fair, and interactive EIA ensures that we bring all relevant knowledge to bear, including that from such usually unrespected sources as local people committed to their area, such as native fishermen.

Wider debates will also raise public consciousness by helping people involved in, or following them, to see the connections between their short-term and long-term interests, and between their own interests and those of others. Increased public knowledge of the consequences of general development directions is essential for our society to agree to make the current sacrifices necessary to achieve sustainable development.

What are some of the process improvements that will particularly help us achieve FSD? At the most general level, there are four possibilities:

- increase public knowledge about decision-making, for example through meaningful screening lists;
- give financial assistance to weaker interests to allow them to undertake and present to EIA forums their own FSD-oriented assessments;
- increase direct interaction among interests in EIA processes so that they are educating each other as well as blue-ribbon panels; and

- require explanations to the public of decisions involving tradeoffs between FSD and short-term specialized interests.

All of these would be very useful, but perhaps the most leverage would come from assisting weaker interests to provide input to decision-makers through EIA processes. These weaker interests could be locally affected communities of public interest groups. There are many environmental groups and international development organizations who would make valuable contributions to debates on sustainability and fairness if they were assisted to identify the implications of plans prepared by people with only short-term local objectives in mind.

This assumes, of course, that EIA will be extended beyond its current project orientation to play a role in the planning of regulations, managerial decisions, and policies. To some, this may suggest a nightmare of public planning processes that slow decision-making to an unacceptable pace. But one person's nightmare may be another's dream. Slowing decision-making might reduce the rate at which we are precluding FSD. In the long-run, though, very slow decision-making would prevent us from taking action to move toward FSD — the status quo will not take us there. What we need then is *efficient*, as well as extensive, public, fair, and interactive EIA. The very challenging task of developing EIA procedures and processes that have all these qualities is one to which agencies such as CEARC might well devote effort.

Content Improvements

If EIA is to play a significant role in promoting FSD, it must not only be applied to the right kinds of government decisions and follow a good process. It must also ask the right questions.

To date, EIA has been concerned primarily with discrete impacts on local systems. Ostensibly its purpose has included ensuring that decisions are taken with an understanding of irreversible consequences for the natural environment. However, EIA has not considered cumulative impacts of man's activities on local or world-wide systems. In part this is because of the narrow view of EIA practitioners — the assessors and their employers.

Environmental impact assessments have studied local pollution and habitat stress but not world-wide cumulative impacts of the greenhouse effects, acid rain, resource depletion, toxin accumulation, and increased risks of disaster. Airport impact assessments have not

addressed the consequences of increased oil usage promoted by expanding air transportation. Petroleum development impact assessments have not considered the consequences of lower prices which increase usage and promote more rapid reserve depletion during a time of high world oil productivity. Social impact assessments of northern projects have intensively studied job creation but not the boom-bust risks for marginal workers of construction phasing, project cancellation, or resource depletion. They have not looked at projects designed to bring northern resources to southern consumers in terms of the impacts of these projects on the sustainability of development in poor northern communities.

EIA has not had a global or long-term perspective because, quite simply, our culture does not. We hardly think about the relationships between most Canadians' overall wealth now and the poverty of some other Canadians today, of many next-generation Canadians, and of most non-Canadians now and in the future. We do not think about the relationship in terms of the direct impacts of our consumption on the availability of scarce resources for others, let alone in terms of the potential feedback of this consumption on all our standards of living because of the other, more dramatic problems such as nuclear war, massive pollution, and ecosystem collapse that will be caused by growing world poverty.

This poses a chicken-and-egg problem: EIA practitioners do not deal with the sustainability issue because our culture does not, but our culture does not because we are so rarely called on to consider the issue in concrete terms at decision-making time. Nevertheless, at the cultural end there are a few people trying to heighten our consciousness. Perhaps a few people working at the EIA end could help to set up a dialectic of positive feedback loops whereby cultural awareness and thoughtful EIA content reinforce each other.

A high leverage approach to ensuring that the right questions are asked in EIA is to insert a clause in all EIA-guiding procedures requiring them to address FSD.

We must remember, however, that another factor preventing EIA from considering impacts on FSD, that is perhaps equal in importance to the restricted spatial and temporal view of EIA practitioners, is that EIA cannot effectively consider cumulative impacts so long as it is restricted to assessing the impacts of projects and is kept away from policies, regulations, and managerial decisions. Only an immense project is likely to be seen as causing major unmitigable environmental damage or resource depletion. Most danger to FSD

will quite correctly be seen as arising from the cumulative effects of innumerable individual actions promoted and permitted by certain policies, regulations, and managerial decisions.

An example of such resource depleting and polluting actions is the daily automobile driving by millions of Canadians. Questions about the sustainability of our oil-consuming way-of-life, and its impact on the consumption prospects for the rest of the world, can best be answered by assessing transportation policies and regulations of all government levels and by assessing day-to-day decisions of transit officials, roadway engineers, and town planners, and not by assessing the occasional major freeway proposal.

Conclusion

To promote fair sustainable development, EIA must be a public, fair, and interactive process through which are assessed the cumulative local and global impacts of policies, regulations, and managerial decisions. That is, EIA can help promote FSD if it is applied to the right decisions, is properly structured, and asks the right questions.

We have seen how these three desiderata for EIA depend on one another. By broadening the application of EIA we cannot improve its utility for promoting FSD if the process is closed and the wrong questions asked. By opening the process we cannot improve EIA's usefulness from an FSD point of view if this process is restricted to looking at local pollution and short-term local social effects. By asking the right questions of hundreds of projects we will never achieve as much as we can by asking the right questions of the policy that induces these projects.

While EIA can help to promote FSD, its contribution will always be inferior to that of proactive planning, including proactive environmental assessment. To determine if a predicted impact is an acceptable cost or not, a decision maker must know what goals s/he is pursuing. Goals are identified through proactive planning. Proactive planning can answer the following crucial questions which EIA, by definition reactive, cannot:

- How high a standard of living can we sustain?
- How should wealth be distributed generationally and geographically?
- How much risk are we willing to take?

Fair sustainable development will only occur when we develop the institutions to implement the answers to these questions at all system levels. This is most important, but will be most difficult, at the global level. In the meantime, EIA can help create the knowledge, awareness, and understanding necessary to develop these institutions.

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A Philosophical Perspective on Sustainable Development

Christian de Laet

Myth or Reality: *Cui bono* — for Whose Good?

In the Euro-american "culture set," economic welfare is based on a material-technical "hyper-reality." It is seen as the fount of all societal good, and environmental considerations are mitigated at the margins, not at the core of economic decisions. This view presupposes a linear model of development "throughput" where convertible resources, including humans, are infinitely available and where conversion wastes find their own natural, unlimited resting places. Such a paradigm, based on a cyclical view of resource conversion involving producers, consumers, and decomposers, has not yet given rise to significant functional changes at the institutional level, for reasons associated with value systems, vested interests, and tunnel vision, *inter alia*.

That some human settlements have survived perhaps thirty-thousand years in the same environment attests to their implicit formulation of a culture whose technical means are stable over time. Such cultures aim at stability and harmony through the balance achieved between the resource base and the community's desires, with the frequent regulating assistance of rituals.

However, unless technology addresses the maintenance of the resource base and is regulated by the societal forces that have given rise to it, it can become an expensive, unreliable, and probably inefficient toolbox. Technology as it is generally known today has spilled over the national borders of the cultures that originated it. The efforts required to adapt technology appear to have been diluted by the attractiveness of its short-term benefits. In this context, environmental protection is not the driving force of development.

The post-World War II myth of development (myth in the sense of a driving image) operates substantially at the expense of the resources that bring the benefits claimed in its name. It is now increasingly recognized that both society and the environment should have effective ombudsmen in high places. The myth of development, which has generally served us well, should be given a shift in focus to accommodate new "realities." To better perceive these realities, we

have the help of the UN Charter of Nature, the World Conservation Strategy, the report of the World Commission on Environment and Development, and our own capacity to read the deterioration of the planet's life-support systems.

The three UN Development Decades have been the setting for progressive shifts from "more is good, and bigger is better" to "basic needs," "inner and outer limits," "conservation for development" and other, largely inoperable, slogans. Now we have "sustainable development." The point is not to argue whether this slogan falls within the orbit of ultimate truths, but to work diligently at planning a course for the space-timeship Earth that will explore other ideational possibilities, far from the usual limitations of present development designs. Our grasp of the sustainable development challenge must exceed our present reach for material/technical means and welfare.

Development, the Necessity for a Driving Image, and the Case for Sustainable Development

The image, or myth, of development is powerful because of its ultimate association with the survival instinct. There is strong evidence that all societies have to hold something deep and strong to be true, a "myth," in order to secure the necessary cohesion to survive and develop. I suggest that the meaning of "development" must be shifted to reflect a more nuanced appreciation of the good of society as a whole. We cannot any longer merely "adjust": western industrial societies are faced globally with a shift of paradigm. This paper assumes that we realize the gravity of the overall situation in the management of the planet.

We cannot go back in time, nor continue to believe that "good times are a-coming" if we pay our taxes and vote. "Development" can no longer be seen as a licence to legitimize neo-colonial power relations, nor as an idealized extension of a Marshall Plan or similar miracle cure. Development must be a genuine program umbrella for the have-nots and the have-less, at home and abroad. We have to face a difficult shift to a future generation that will enjoy considerably fewer natural resources and related amenities than we have. Nature will have to undergo a few resounding crashes before we heed the full warning. The Brundtland Commission played the role of impartial ombudsman to the maximum extent possible, but we are still short of working agendas without built-in failure mechanisms that defer the nagging and costly issues to better times.

In our presumed first wave of development, some ten-thousand years ago, the human race became more sedentary agriculturists, depending on shifting crops and slash-and-burn techniques. Low population density and low expectations of life acted as a natural dampener on the gradient of the rise from survival, through subsistence and security, to a "surplus" leading on to satisfaction.

The notion of environment was not likely to have been meaningful. Man was one with his environment, having internalized it in answer to the immediate needs of his group. His relationship with the Divine in all its environmental aspects resulted in deep questioning and in the working out of more secure options. He informed himself of what he had transformed and he re-formed the next rounds in endless iterations that eventually led to his taking "form." This constant cyclicality, in the mind of Jean Gebser, was imposed by the seasonal clock and triggered the development of a sense of culture, of spiritual and technical ends and means.

Life and living responded to the success obtained in maintaining harmony and stability, a prerequisite to sustained growth. The outlook on growth had to be predicated on conservatism and on the least amount of modification to successful transformations. Natural disasters were calamities embodying very high risk; they probably triggered the jump shifts that provided new baselines for development and, in many societies, opportunities for the next major phase.

The second wave, which can be placed at the time of the industrial revolution of the Middle Ages, involved the mastery of energy subsidies and the unpackaging of more and more complex and costly energy bundles. Time became linearized and segmented, first through the canonical clocks, then through watch-keeping, down to the nanoseconds of today. The mechanization of agriculture was nothing more than the mechanization of labour; progress became associated with technological advances and the assertion that social satisfaction would follow. Man in the family, the group, the community became progressively mobilized by government and by religion; "Nature" was only acknowledged as a supplier of natural resources. The myths surrounding our *Drang nach Natur* as an unlimited and ineffable source of amenities were actively dismissed! Conservation was viewed only as an image. In the need to secure a continuing supply of resources for urbanization and industrialization, preservation of the natural order was viewed as an anti-progress, a counter-productive attitude.

By the mid-19th century, Canada was the backyard of Britain's Navy: the loss of the Crimea led to the extinction of Maritime white

pines and hardwoods. The Reciprocity Treaty with the United States required us to take a hard look at nation-building activities. Seemingly infinite horizons and the size of the country, exemplified by the transcontinental railway and images of endless immigration, were strong incentives to believe that resources where inexhaustible.

This had some well-documented repercussions. In the West, settlement practices led to the complete eradication of prairie ecosystems and recent rural modernization continues to exhaust the soil at an alarming rate. In fact, much of the last hundred years of Canada's settlement and nation-building has been the scene of mining activities: forests, minerals, fish, soil, and air.

Canadians live under the illusion of size, supported by the undisputable fact of occupying the second largest country in the world. Where and why then should there be a sense of restraint when the larder is so full? The very size of Canada, and the climate that "forces" us to huddle along the 49th parallel, contribute to myth-making and to the resulting amnesia as to the state of our resource base.

The establishment of national parks, slightly over 100 years ago, testifies both to the continent-wide nature of the problems of settlement and transportation and to our capacity to rise above petty economics (regardless of the effective distance of the parks from the centers of urbanization and industrialization). That we acted wisely, no one doubts; it is probably churlish to ask if we were really wise or if we merely displayed the residual societal conscience of our European forebears.

The Role of Conservation and the Case of Canada

Western society has developed deeper strategic outlooks and wider vistas in its attempts to encompass the large and complex systems we live in. But distance alone does not guarantee clear sight, much less vision. Is conservation merely the outlook that will secure a longer-usable resource base, through wider-spaced areas over longer distances? Only Canada can afford this "vision"; but for how long? Other nations have had to exercise conscious societal control over their resource base: they could not go further, unless they extended their hegemony abroad. Canada may not have been at the sack of Africa but what of our own "quarries," remote enough that the decision makers could not be restrained by the effects of their demise. "Trees don't vote" answered a minister when told of forest fires raging unrestrained, as he was about to defend his estimates. The point is: now trees do, in a way.

The mechanization of power sources and the infrastructural investments made in resources development and in water supply were and are such that a calorie of agricultural output can only be secured at a higher overall cost in caloric input.[1] Low food prices have been a concomitant to the traditional nation-building policies of urbanization, but they may act as a structural obstacle to sustainable development policies. The underpricing of natural resources, if continued, would represent a gross and unsustainable baseline for policy making. Soils are not considered an economic value until used for growing crops; a standing forest has no value until cut; water still flows, doesn't it?

We may have been excused from thinking that if resources had such value, they should have a price; a zero price as long as we can afford it, but a price just the same. The mere threat of metering household and commercial water in a key metropolitan city was sufficient to bring down its consumption by a third!

The stage was set for a shift from remedial concerns to prevention, recasting preservation of species and of scenic amenities, conservation of wildlife and of parks and natural reserves into a deeper concern for underlying issues of biosphere management. Preserving the societal and economic structures that could plausibly support both traditional conservation and standard economics was considered impossible. In Canada, the myth of size, distance, and the largest percentage of the world's fresh surface water added to the improbability that drastic change would be contemplated: adjustments and, in rare cases, larger-scale changes (such as the establishment of territorial governments) were considered sufficient to meet otherwise incomprehensible challenges.

Decentralization to meet the needs of local, marginal, and isolated communities and habitats was interpreted as concomitant to establishing more federal presence in the provinces and territories. The wide range of options available to an enlightened application of cooperative federalism (as in the cases of fisheries or of criminal justice) does not seem to have been seriously contemplated.

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[1] The ratio is now thought to be from 20-to-1 to perhaps as high as 100-to-1 in the case of some specialty crops. With this background, the policy intent of the United States to remove all agricultural subsidies by the year 2000 smacks of pure millenarist delusion. Note that the present fuzzy system of accounting leaves out the productivity losses of the soil and promotes the public belief that a "$4 bushel of wheat" is within the ballpark of "real" values. This myth serves to maintain the lid on the price of Third World agricultural exports: how could OECD countries accept to pay less-developed countries a nearer-to-correct ecolo/economical cost several times higher, and who would ultimately pay it?

The Meech Lake discussions may turn out to be a momentous turning point in the realization that, without sufficiently informed public opinion and without a sufficiently perceived need for national policy at a regional level, we are bound to stay institutionally committed to the limbic contortions of fight, flight, feed, and perpetuate. In this context, it is not possible to look at free trade discussions without moving from the economic context to questions of regional stability, transcultural harmony, environmental health, and sustainable development. The background to these necessary questions is an unclear, distant horizon. Cautious optimism is the most positive stance to espouse, but studies in optimization would clearly assume that the ship is safe. If it is not, and we posit that much work remains to be done to make it so, instruments (in fact, social inventions...) such as EIAs and benefit/cost analyses are as much a delusion as bargaining for deckchairs on the Titanic. I cannot reiterate enough the need for more systematic baseline covenants and for a more consensual perception of the problems ahead.[2]

After the UN's 1972 Stockholm Conference on the Human Environment, the shift toward a blend of modern economics with environmentally sound technologies was considered sufficient to bring about necessary environmental protection. Lessened, and less overt, damages would be sufficient to guarantee the expected growth of the economy. For the lesser developing countries, the concept of "additionality" was suggested, whereby a purchaser of environmentally-damaging products would be asked to make an additional payment to compensate for the impacts. An ambassador proposed that environmental warrants be issued so that a polluter would have an opportunity to rehabilitate elsewhere the options he had forfeited in his own factory.

Environmental rights would be issued to those who did not pollute where they had the capacity (and possibly the legal right) to do so. Consensus was hard to generate since for many it would have involved the surrender of vested interest that, over the years, had acquired sacrosanct value for their owners.

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[2] The Union of International Associations (UIA), from its Brussels headquarters, is preparing a global project leading to an encyclopedia of conceptual insights of the world's cultures. I suggest direct participation in the UIA research project. This should go a long way to emancipate our cadres and to clarify the policy pathways effectively open to us, nationally and transnationally. A Canadian contribution, based on the diversity of our cultures, sites, habitats, and ecosystems (in the latter case, most of the world's except for tropical rainforests!), could take the form of an atlas of the "information" interlocks (and interlacks!) related to the "trans-formational" challenges of sustainable development. Compared to these challenges, the Future of Growth debate withdraws to a lesser level of societal cybernetics.

Making Preservation and Technology Compatible: The Question of Social Tool Boxes

Environment can no longer be dismissed as that "which is not oneself." It is no longer merely the "social" cost which we are forced to assume as part of our "production" cost. No longer is there on Earth any sustainable haven from pollution, now that even the high seas[3] are "formally" forbidden and Third World countries "technically" unavailable.

The present concern for sustainable development or for environmental protection finds its roots in the interactions between natural resources and the technical and social toolboxes perceived to be useful for their development. The social mastery of technology is outside the direct purview of this paper but the development of the "social" innovations required to manage the present situation is well within it. Cost/benefit analyses, surrogate market pricing, economic valuation of intangible collective goods, and environmental impact statements are all "tools" that have been shaped in the hope of managing technology.

Among the tools we have been relying on is one with an increasingly questionable future, namely social cost/benefit analysis. With its rather trivial lack of appropriateness, its lack of foresight, and its unwieldiness for cybernetic purposes, this tool appears useful now only to endow previously taken decisions with a veneer of legitimacy. Yet it is regarded by its purported promoters and defenders with a curious seriousness of intent that casts great suspicion as to the rest of the present planners' toolboxes. This is only now being perceived by mature, experienced, and sensitive students.

What tools do we have to cope with the working out of idealizable but mainly unknowable, if not inexpressible, images of the paradises we seek? We are collectively, if not criminally, short of the tools required to deal with the intangible, the non-specifiable, the non-quantifiable. We may have some of the tools, but they have only been tested so far in the environments of small-scale ecosystems and stable, cohesive, and convivial communities. The still fragile structures of these

[3] The Law of the Seas conference cycle was the largest single innovative legal step since Hugo Grotius' "social invention," the publication of "De Mare Libero." The Convention on International Trade in Endangered Species (CITES) was a benchmark for endangered species, as was the Ramsar Convention (named for the site in Iran of the first IUCN conference on wetlands and endangered species) for wetland ecosystems. But all these do not make up a sufficiently convincing case that we, as a species, have realized the gravity of our predicament.

experiments may be the sign of things to come, but the culture sets that created these social innovations and shaped their social tools are distant from the gladiatorial arenas of win-or-lose legalities.

Much of the legal systems that subtend our society are embedded in now outdated principles ruling the allocation of right or wrong among competing property owners. *Res Communis* and *Res Nullius* are the losers in this game which, it turns out, leads to a lose-lose situation for us all, and likely for the planet as well. To further reduce collective rights to those that an individual can actually own, possess, and utilize on his own cannot justifiably be the ultimate outcome of law.

A Tentative Conclusion

A philosophy of sustainable development must of necessity encompass the possibility of change. For change not to be left to chance, intuition and imagination must be allowed the free play of erstwhile entrepreneurs. Without this, our social toolbox will be lacking.

New development tools and new economic objectives will be shaped together. Optimally, neither set will escape the societal controls that are necessary for a sound culture of technical means to emerge. Linear thinking will progressively yield to the demands of interdisciplinarity in the recognition that technology will no longer be able to muster financial support without collegial agreement.

There is for example a high risk in procreating the now-traditional sets of dualities found in Euro-american cultures. Such dualities tend to crystallize simplistic models of decision-making unless conscious effort is brought to bear to insure that clusters of supporting decisions can evolve in resonant advocacy rather than becoming frozen during adversarial opposition.

Technological and informational tools may become selectively isolated by appropriating elites: language may become further specialized in unnatural jargons. The choices of technologies and of other transformational tools such as information will be designed to suit both individual groups and their interaction. With emerging biotechnologies and with electronic media reaching the individual, the possibilities for success and failure are endless.

Unless clear thinking is brought to bear, the eagerness to embrace change and its attendant errors may turn to sullen anxiety. The transformational tools of societies will become overly simple to

appropriate for negative or selfish motives. It is with this broad imagery as a backdrop that we raise a note of cautious optimism about EIAs. They have the potential of being a uniquely useful tool, but on their own they cannot carry the responsibility that in the end they will have to bear.

Our leaders must interpret new realities, changing paradigms, and the ultimate finiteness of our supplies. There are signs that generalized stresses force leaders to progressively withdraw from fiscally and electorally unproductive fields of social and environmental services. One of the hopes we have is the rise of the so-called "third" sector, operating in the overlap between "government and society." This overlap is still insufficiently charted; although, as a field for the expression of social, cultural, and environmental commitment, in national or in international affairs, there is a rising constituency of dedicated and capable NGOs.

Public good encompasses the collective good; but whereas public goods and services are within the keep of government, collective goods and services demand the commitment and the involvement of the people to secure them. No amount of public treasury can supply health, education, development, and the enjoyment of life; at best it can provide hospitals, schools, subsidies, and recreation areas. This awareness of the fickleness of the claims made on our behalf by public or private leaders makes it difficult to plan on the basis of yesterday. New social and environmental values are in the making but we cannot yet determine whether they will be adaptive or merit their own axiology.

The environmental lessons are sufficient to remind us that many colonizing practices of industry will be shelved as past chapter in our history. But the surge of compensatory tools in the form of plausible, sustainable, or even valid practical models for collective learning cannot yet be seen clearly. Such modelling tools, I suggest, are essential for the realistic interpretation and mediation of sustainable man-nature bonding systems and of sustainable human ecology-local economy relationships.

We are as yet unable to design economies capable of functioning sustainably and at reasonable scale based on principles such as the full recyclability of all material goods or the zero net waste concept. We are increasingly aware that in the long run, and perhaps in the not so long run, we will have to design our production and ancillary activities along the lines of natural systems where producers, consumers, and decomposers are in iterative cyclical sequences rather than in linear throughput.

Sustainable development is a concept that carries the notion of design. We must establish the multiple jump-shifts of its unfolding. EIAs may well serve the purpose, albeit with modifications: after all, the basic tool already exists.

Guidelines for Environmental Impact Assessments

An EIA is representative of social technology. It is a device that belongs to the "social tool box" of sustainable development. It is an informational tool that should promote our management of projects to the requisite degree of success. Projects are transformational in nature and, as such, they need an adequate, appropriate, and timely set of technical and management tools. The transformation/information loops are all encompassing. But, EIA can help insure that the cycling of trans-, in- and re-formation fits smoothly with that of other projects occupying the same conceptual or functional "space," and that the circumstances under which they take place contribute near-optimal benefits to society, as well as to specific role-players.

The concept of sustainability promotes an advocacy relationship between development and the environment, where considerations of time and space render their erstwhile boundaries diffuse, if not inoperative. Internal rates of return and social discount rates will have to be given new interpretations. Investments over and beyond the standard limits of "business" criteria may justify incentives and rewards while the opposite case would draw penalties. Warrants and rights may be issued to keep societal accounting and collective, or individual, preferences balanced. Some "global" imperatives may unbalance the accounting of otherwise reasonable regional projects. The concept of additionality may be used whereby the society assumes the additional national or regional burden as a contribution to the world heritage. The concepts of rarity and of scarcity may equally apply to distort otherwise environmentally sound projects.

EIAs are planning and management tools. They can serve to bring up information which, if taken for granted or ignored, would adversely affect the outcome of a project in the long run. There will be fewer and fewer opportunities for project proponents or regulators to successfully invoke lack of knowledge or uncertainty of outcome. Both are endemic burdens in decision-making but their frivolous or capricious use will likely be increasingly resisted.

These remarks are only intended to situate EIAs within a perspective of changes in societal environments, in social preferences, in prevailing collective wisdom, and, last but not least, in the require-

ments for the sustainability of our global commons. The concept of justice is progressively taking on different and wider dimensions than those served by any one of the legal instruments designed in its services, either locally, nationally, or globally. It is not my purpose to comment on the merits of any one such instrument, or on its presumed range of effectiveness. The plea is made, however, for the acknowledgement that the dire perils which may face us collectively can be substantively reduced by the wise management of local, project-oriented choices.

The legislative, legal, and judiciary systems may have to be reviewed and reformed to encompass the wider interpretations of right or wrong that EIAs will yield. Current bodies of scientific thought will have to cope with the "exceptions" as well as with what is in the compass of the "rules." Absolute certainty as to cause-and-effect linkages will yield to preponderance of circumstantial proof. The burden of proof may be shifted and innocence will not necessarily be deducible from the absence of direct and uncontrovertible proof of guilt. Legal determinism may blend more substantively with jurisprudential probability. Access to courts will likely be less restricted and the rise in the defense of property rights may be extended to collective claimants in support of the common good.

EIAs should be active social management tools, resisting the danger of merely subscribing pro forma to notional obligations and of falling into procedural chicanery. EIAs are not only project-oriented tools. They will increasingly become societal indicators of the "regional" meaning of development. They might play a role similar to that of political by-elections. As potentially sensitive barometers of informed opinion, EIAs should be constantly monitored for continued relevance and effectiveness. As in the case of "appropriate technology," the criteria of validity in the selection of specific EIA procedures should be based on a complex set of parameters, many of which are beyond the purview or the interest of the direct promoter.

The EIA should be linked to the monitoring and validating of its conditions of project approval. Besides the overall evaluation of the completed project, the EIA should also be able to "go back in time" and question the umbrella program that gave rise to unacceptable projects. It might also yield useful comments for the policy-makers responsible for the programs that evolved. That is to say, there is no specific limit to the continuum of concerns with which an EIA can deal. Besides these "societal management" concerns, EIAs are embedded in a number of technical concerns. The project whose impact is being studied may call for manpower not readily available,

which has to be trained, or imported, or "leased." This consideration may affect the overall economy of the region, from one of self-reliance to one of dependence, from basic self-sufficiency to external expectation. The technology used may aggravate or alleviate such dependence, with the further effect it may have on "national identity." The project may or may not be ecologically sound, in human or in natural terms. This is merely a cursory glance at the necessary complexity that EIAs should acquire so as not to become the unwitting tools of those who would benefit from their lack of rigour.

EIAs should probably play a role in assessing the competitive nature of a project with other projects planned, developed, or operating in the same "eco-systemic" context. Protecting micro-environments, conserving competing resources for multiple ends, balancing quantity and quality aspects of resource use, allowing for amenity and situational use of resources as well as for their extractive, transformational use — all these are considerations which would add to the stature of EIAs as tools in resources planning and management.

Gandhi's reminder that there is enough for everyone's need but not for their greed will slowly emerge as applicable to the Canadian scene, regardless of our 10 million square kilometers and large reserves of fresh water. Since resources will axiomatically be needed, and since they will progressively be priced at replacement value rather than at give-away levels, EIAs will tend to favor projects involving substantive local processing and therefore yielding higher "value-added"-ness. EIAs should thus also become an instrument of regional economic development and stability.

Sustainability is often equated with stability, harmony, and durability. These are features that are also associated with health. The analogy with health, and for that matter, with education, reminds us that development is a culture-based set of activities. Dysfunctions, like deficiencies in health, can often be attributed to actual or potential stresses to the human and/or natural environment. In this context, EIAs may represent the processes aiming at identifying and managing environmental stresses.

Stressors are present in many, if not all, environments: noise, radiation, overcrowding, pollution and the like are causes of stresses which affect the natural and human eco-systems differently. These "stressees" exhibit conditions that can be alleviated by a variety of means ranging from the removal of the condition (as acetylsalicylic acid handles headaches) to the relocation of the stressee, the removal

of the stress (e.g., through habituation practices) or the eradication of the stressor (the interdiction of noise or radiation-producing activities.) Similarly EIAs can, and probably should, lead to alleviating or eradicating measures that should be incorporated in project design and implementation.

There is, however, a need for EIA processes to have the capacity to follow through on their final decisional "loop" and insure that the conditions attached to project approval are in fact observed. This validating mechanism usually falls outside the purview and mandate of the EIA agency. In this manner, a conditional "yes, but..." approval may be interpreted and acted upon as an unconditional approval.

Without a strong sense of policy among an informed public, the requisite development of an environmental ethic is stymied. Access to political endorsement and public support through professional communicators as well as litigations based on the finer points of law are substituted for processes where natural justice would emerge through public consensus on social responsibility. There is still a long way to go in a fairly recently settled country, and EIAs, properly planned and managed, can be a uniquely useful tool to the practical development of a national conscience.

Actual projects have the unerring capacity of meeting realtime challenges and the needs for interdisciplinarity, equity, and participation. Such features are an integral part of EIAs, of their implied promise to produce reasonable, manageable consensus on given projects and their interrelated spillover effects. They should have the capacity, as well, to investigate the root decisions that gave rise to the project.

Conclusions and Recommendations on Further Directions for Research and Development

Barry Sadler and Peter Jacobs

Introduction

The discussions at the two round tables (Appendix 1) provided a valuable basis of ideas and suggestions for formulating recommendations on further research on environmental assessment that can assist the achievement of sustainable development. We have drawn freely and interpreted liberally from the advice of participants in drafting this section. Although our conclusions and recommendations are directed at CEARC, the three main directions for research set out below may be of interest to other institutions and individuals concerned with environmental assessment and sustainable development.

Criteria of Sustainability

Sustainable development, appropriately defined, provides both an overarching goal and a frame of reference for public policy. It is an important unifying concept that encompasses social, economic, and ecological imperatives and interests. A certain degree of strategic ambiguity in such concepts is useful; however, the nature and relationship of the key values, that is, what broadly constitutes sustainable development in the Canadian geopolitical milieu, requires policy definition: the establishment of goals, and guidelines for achieving them.

In that context, there is a need to establish the "governing perspectives" on sustainable development. These should specify and exemplify the nature and relationship of the common denominators of sustainable development, namely economic growth, ecological integrity, and intra- and inter-generational equity. A good deal of the work presently underway promises to be helpful in making these considerations more transparent and legible. Key examples include studies of economic methods of resource valuation and the preparation of environmental accounts. The next logical step is to extend such research to social and community perspectives and to develop integrated indicators that will assist decision-making; for example, by clarifying the trade-offs among key variables and highlighting appropriate actions that promote sustainable development or redevelopment (Table 1).

Table 1
A Preliminary Checklist of Sustainability Criteria

The adjustments that seem necessary in the way we "frame" environment and development decision-making are exemplified by the following criteria. A series of basic questions elaborate the three themes of economic, ecological, and social/community sustainability and their policy and institutional integration in assessment and choice. Emphasis is placed on establishing the mind set for reviewing and recasting development in post-Brundtland perspective. The approach taken is best thought of as an *aide-mémoire* to scoping issues and focusing the decision-making process, one which can be applied to organize and illustrate policy analysis and project evaluation. We envisage more detailed procedures and guidelines as the next phase for research and development.

Economic Sustainability

Why is the proposed development needed? What is the economic justification? How is the proposed development expected to meet human needs, improve net social welfare, or community wellbeing? What is the full slate of benefits and costs; i.e., direct and secondary — monetarized, physical, and qualitative? Is the project economically efficient and viable; i.e., does it require a financial or environmental subsidy?

Ecological Sustainability

What potentially significant or irreversable cumulative effects are anticipated? To what extent might the development proposal deplete renewable resources or impair ecological integrity on a local, regional, or global scale? How will the proposed development affect, for example, nutrient recycling, soil capability, biomass, water quality, and so on? What compensatory measures can offset deteriorations in resource productivity or ecological capacity?

Social/Community Sustainability

What is the social/community rationale for the development proposal? To what extent, for example, does the development proposal promote fair and equitable distribution of benefits and costs? How does it maintain choice of lifestyles, take into account minority rights, and meet community aspirations, including those for self-reliance and self-determination? Who will be allowed to participate in the development, share in the benefits, or receive compensation for unavoidable impacts?

Policy and Institutional Integration

What are the key interdependencies among economic activity, natural processes, and social/cultural values? How have these changed in the past, how are they changing in relation to present trends, and will they be likely to change in the future under different policy scenarios? Where are the spatial boundaries of these interreactions best drawn; do they have local, regional, or global impacts and implications? What policy, institutional, and technological options are already or potentially available to manage these effects, including those which encourage greater efficiencies in the use of non-renewable resources or promote the transition from "hard" to "soft" energy approaches?

To what extent does the proposed planning/assessment process identify the substantive issues and their policy and institutional implications, suggest alternative actions for resolving problems, elaborate decisional criteria, and establish the conditions for monitoring, auditing, and evaluating progress in each of these areas? How will this process foster an adaptive approach to coping with scientific policy and technological uncertainty, changing values, and intra- and inter-generational equity? What procedures will be followed to integrate economics, ecology, and ethics, trade-off science-based facts and cultural values, including those derived from traditional knowledge systems; and relate decision-making to the broader range of policy and management options?

Source: Jacobs (1990)
Sadler (1990)

CEARC can and should contribute to the development of such frameworks. There are two directions in which the Council might focus its initial efforts:

- ecological thresholds of sustainable development, articulating key organizing concepts such as productivity, variability and resilience; and

- community perceptions of sustainable development, including those that characterize metropolitan and urban centres, small towns and villages, and native settlements.

Improvements to Assessment

Environmental assessment is a necessary but not sufficient process for achieving sustainable development. It is a reasonably well tried and tested instrument for project planning and impact mitigation. But the process, in its institutionalized form, is often too narrow in focus and restrictive in scope of application to capture cumulative environmental and social effects. These occur as a result of a multitude of technological changes, economic activities, and resource use and management practices. Other planning and regulatory procedures, of course, are also meant to be in place to manage and offset the side effects of development. But the underlying reality, alluded to above, is that neither the market place nor government satisfactorily account for the real costs of development or the true value of maintaining natural resources, such as clean air and water, wildlife habitat, and so on.

Research on improvements to EA processes in support of sustainable development should be linked to these broader issues of evaluation and decision-making. In this regard, there is an urgent need for "second generation" assessment processes, employing new and expanded concepts, methods, and procedures. Sustainable development assessments (SDAs) should explicitly address the economic, social, and ecological interdependencies of policies, programs, and projects. These must be coordinated with other policy and management instruments as part of an overall approach to environment-economy integration. Some formidable scientific and institutional difficulties (and, no doubt, disciplinary foot-dragging) will be encountered in designing integrated tools for assessment, planning, and decision-making. Not to begin this process, however, is to miss the point of the paradigmatic change that is taking place in environment and development thinking.

CEARC, in concert with responsible agencies and other interests, can and should be involved in fostering an integrated approach to development assessment. As a first step, the Council might focus on:

- the trial application of an SDA framework for project review, i.e., what is entailed in terms of the operational integration of the different types of impact and risk analyses, public consultation, and other decision procedures; and

- the stategic relationship of this expanded approach to the broader range of policy instruments for resource and environmental management (e.g., conservation strategies, land use impact planning, cumulative effects assessment, monitoring, and audit) and the potential mix of public regulation and private economic measures and incentives (e.g., common property fees and taxes, tradeable pollution quotas, and liability insurance).

Pilot Studies and Demonstration Projects

The directions for research outlined above afford opportunities both for reworking past and present CEARC programs within the framework of sustainable development, and for launching new pilot studies and demonstration projects. In that context, for example, the background studies and the research prospectus on the assessment of cumulative effects point to new perspectives on ecological problem-solving (CEARC 1988). Many ideas and concepts relating to incremental stress and major structural surprises in regional systems are relevant to an understanding of ecological thresholds of sustainability. Further work on cumulative assessment methods and procedures for wetland ecosystems might be directed at enhancing our understanding of regenerative capacity and resilience to the changes induced by development activities.

Round table participants also emphasized the importance of demonstrating the potential applications of EA to local concerns and problems. This approach involves creatively scaling the process down, making it more flexible and user-friendly. Ideas for promoting new EA orientations include encouraging municipalities, businesses, communities, and environmental interest groups to undertake their own assessments. An experimental management strategy was mooted in which support would be given to non-proponents in federal or provincial public reviews to prepare such studies. This approach might have particular applications to native peoples, who have distinct perceptions of development impacts and modes of participation in review processes. A cooperative process was also proposed in which all participants, government, industry, and intervenors, would

engage in joint fact-finding as part of the preparation of an EA. This approach might be linked to further research on alternative means of dispute settlement (CEARC 1989). Such initiatives have considerable merit in our view, and would respond to the call made by the National Task Force on Environment and Economy (1987) for demonstration projects to test new ideas and methods.

We recommend that CEARC consider pilot studies that demonstrate:

- traditional ecological knowledge held by native peoples and its applications to environmental assessment in support of community-based development and local conservation strategies; and
- the utility of cooperative assessment of urban problems, perhaps as part of a broader research program to gain perspectives on the sustainability of cities and human settlements.

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Appendix 1

A Synopsis of the Round Table Discussions

Introduction

This report summarizes the discussions that took place at two round tables held in Vancouver and Montreal in late 1987. It outlines the main themes that were covered by participants in their review of the relationship of sustainable development and environmental assessment. A diversity of ideas on the subject was exchanged at the two meetings. Many aspects of the discussions are pursued in depth in the papers included in this volume. The following account covers the key issues on which either consensus or counter-argument emerged. For round table participants, this will appear as a formal packaging of what was, in reality, a wide-ranging and free-wheeling discussion.

Background

A common format and agenda was followed at the round tables. Opening remarks were made by Peter Jacobs, who served as chairman of both the Vancouver and Montreal meetings. He outlined the context, objectives, and process of the round tables. The framework paper drafted by Julia Gardner was used to focus the initial exchange of views. Subsequent rounds of discussion were then structured along the lines of interest established by participants. An additional element at the Montreal round table was a review of proceedings of the Vancouver meeting. Both events, however, quickly took on their own character and direction.

Initial Perspectives on the Problematique

The magnitude of the environmental changes now underway is a matter of serious concern. A new order of global problems is occurring, exemplified by the impacts of industrial pollution and land clearance on the atmosphere and climate. Scientific knowledge and understanding of the processes involved is partial and our capacity to predict and manage events is correspondingly limited. We know enough, for example, to identify global warming as a serious and emerging threat but not enough to estimate with any certainty when significant or irreversible thresholds will be reached. The environmental issues that underline the challenge of sustainable development

lie beyond the competence of any one scientific discipline. Environmental assessment (EA) must become a broader, more multidisciplinary process characterized by extended time and space boundaries to effectively contribute to the management of the global and regional commons.

Canada can and should continue to play a leading role in the development of EA processes. During the last fifteen years, a considerable body of experience and expertise has been built in this area. The track record of environmental decision-making, however, contains no grounds for complacency. Examples of environmental deterioration can be found in all regions of the country, and this reflects, in part, on the inadequacy of the underlying processes of assessment, planning, and management. With EA, in particular, there is a pervasive gap between accepted canons of sound practice and their application in everyday decision-making. The first order of business in deploying EA in support of sustainable development is doing what we preach.

Frame of Reference: On the Elephant and the Blind Men

With the above problematique in mind, the metaphor of the elephant and the nine blind men by which Julia Gardner characterized the relationship of environmental assessment and sustainable development is an apt one. Each of the assessment approaches she reviewed contains elements of truth, but no one approach contains the whole picture. As Gardner and others noted, each approach was designed for a specific purpose, and some of these are only incidentally related to the notion of sustainability.

Also recognized were certain methodological difficulties, including the uneven documentation of the application of these approaches. It is not clear, for example, how the approaches affect environmental management and decision-making. The strengths and weaknesses of the nine approaches suggest the possibility of developing a more encompassing model. Some participants recommended that CEARC pursue this line of enquiry, noting that the various approaches are evolving rather than static and are interrelated in the sense they all draw from and build on each other. Others were not persuaded of the value of further "meta-research" and recommended an investment in case studies of the practical applications of EA. (See also, "On Improvement to Environmental Assessment," below.)

On balance, round table participants considered Gardner's substantive principles and process criteria for evaluating sustainable

development to be a useful frame of reference or *aide-memoire* for EA practitioners and administrators. At the same time, some had difficulty with the terminology used. The substantive principles, for example, were variously referred to as goals, descriptors, or considerations. It was widely agreed that further clarification is necessary.

At present, there is no common understanding of what constitutes sustainable development, or how EA and related planning procedures can deliver this goal. It is vital, however, to see this relationship in a holistic and synthetic perspective, as involving much more than just damage containment or the minimization of the negative effects of project development. The environmental ethic that underpins sustainable development transcends the limited objectives of impact assessment as currently practised. Aldo Leopold's (1948) evocation of ecological integrity, the importance of land as a living community, represents a sound starting point for interpreting the web of interactions that link ecology and economics to each other and to culture, technology, and politics.

The critical challenge, of course, is to identify and incorporate a guiding environmental ethic into decision-making processes so that it becomes co-equal with economic considerations. Social values and attitudes are political touchstones in this respect. Environmental concerns rank consistently high in public opinion polls, which may indicate that critical levels of pollution are being perceived. This is creating a constituency for sustainable development and a climate of demand for policy reforms in decision-making, including more effective EA, planning, and management. And institutional change, in turn, becomes the vector for promoting the ecological imperatives of sustainability.

On Sustainable Development

Sustainable development is an important idea for unifying environmental and economic considerations and interests. The broad definition adopted by the World Commission on Environment and Development was accepted as a useful and understandable beginning point. It will, however, take time to achieve a working consensus on national and provincial goals and regional strategies for implementing sustainable development. A considerable legacy of conflict and suspicion exists between the parties involved in the marriage of ecology and economics. The National Task Force on Environment and Economy, for example, reportedly adopted a general concept of sustainable development because a more specific, operational definition would have stalled the dialogue among members.

At the same time, there are evident problems in leaving the notion of sustainability wide open to all claimants. Technological optimists, for example, can and do consider that the present pattern of resource use is sustainable. Environmental pessimists argue the opposite case. It is unclear how these divergent views can be reconciled in policy-making at a sufficient level of resolution to give direction to planning and assessment of development activities. Conservation strategies, or blueprints for sustainable development, now being prepared by the federal, provincial and territorial governments, are widely seen as a potentially important policy integration mechanisms. Their effectiveness in this respect, however, will largely depend on the extent to which they can be coordinated with other policy instruments, such as the national and provincial round tables, and the systems presently used for land use planning, resource management, and so forth. It was suggested that CEARC, in consultation with the responsible agencies, might convene a workshop dealing with these relationships.

On Improvements to Environmental Assessment

Environmental assessment, in principle, was adopted to ensure that development is sustainable, that is, development does not irreversely damage essential ecological processes and/or foreclose other resource values and options for use. This approach, in practice, has been institutionalized along relatively narrow lines. (See also, "Frame of Reference: On the Elephant and the Blind Men," above.) It is typically applied in Canada and most other countries only to development projects that are individually large enough to generate evident impacts. Other activities and management practices, collectively numerous, escape assessment. The sporatic application of EA contributes to the incremental, cumulative erosion of ecological integrity.

More integrated frameworks of environmental assessment are required to identify and track the consequences of cumulative loss and change in the regional capacities of natural, modified, and degraded ecosystems. Stress ecology focuses attention on the human-induced perturbations that impair resource productivity, as compared to natural succession which leads to rejuvenation. The practical applications of this perspective are expressed in cumulative effects assessment. Further work in this area by CEARC was supported by participants. But it was also recognized that the analysis of cumulative impacts can only take us so far.

The effective deployment of EA in support of sustainable development can only be achieved as part of larger policy and institutional

reforms to decision-making. Existing processes are felt to be seriously deficient. We must move, in the current catch-phrase, from "react and cure" to "anticipate and prevent" modes of planning and management, from "controlling the bads" to "realizing the goods." This means an adaptive, goal seeking, interactive style of decision-making in which specific environment protection objectives, standards, and priorities are established and linked to economic objectives through the preparation of conservation and selected strategies. (See also, "On Sustainable Development," above.) In this context, EA of development activities should be directed at measuring the extent to which these targets are being met and provide a basis for correction and control. The strategic emphasis should be on an ecosystem approach, and should focus on the capability of the receiving environment to support anticipated uses and assimilate wastes, rather than on project design and pollution technology *per se*.

EA must be linked upstream to the higher echelons of policy-making and downstream to procedures for monitoring and audit, which facilitate learning and feedback. This will require, on the first count, the design of new forms of analysis that allow policies and programs to be screened and reviewed in terms that are understandable and relevant to senior decision-makers. In this respect, the traditional environmental *impact* statement is an example of what we must avoid. Such cannot remain bulky compilations of technical data that politicians and mandarins have neither the time nor the inclination to digest and consider. The emphasis instead should be on the identification of ecological and social *issues* and *implications* of proposed directions in development. For this to be undertaken effectively, we need environmental accounts that give a reasonable approximation of net and relative adjustments in resource stocks and ecological values. Such a framework can be used to direct EAs and integrate them with other planning and management activities aimed at sustainable development and sustainable redevelopment, such as the rehabilitation of degraded resource systems and abandoned industrial sites. Environmental monitoring and audit of the losses and gains in resource productivity and the relationship of prediction against performance provides the basis for policy adaptation and process improvement.

A larger task remains outstanding. In order to contribute fully to the advancement of sustainable development, EA must become much more than an institutionalized process of senior governments, and the route that industry must follow to gain project approvals. It should be seen and utilized as a problem-solving tool by local municipalities, community, and interest groups, and small industries and businesses.

The decentralization of EA must be supported by a number of institutional and methodological changes that support application of the approach to an array of everyday issues of development planning and management. Examples include a focus on scoping techniques that emphasize the gathering of strategic intelligence rather than the accumulation of data, and the organization of this information to facilitate negotiated and mediated settlement of environment-development disputes. Local municipalities might entertain the employment of impact assessment procedures to augment the productivity of existing land use planning instruments, and to assist with the selection of appropriate waste, energy, and transportation options. All of this would be helpful in covering the multitude of activities that presently escape assessment and contribute to cumulative environmental impact.

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Appendix 2

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